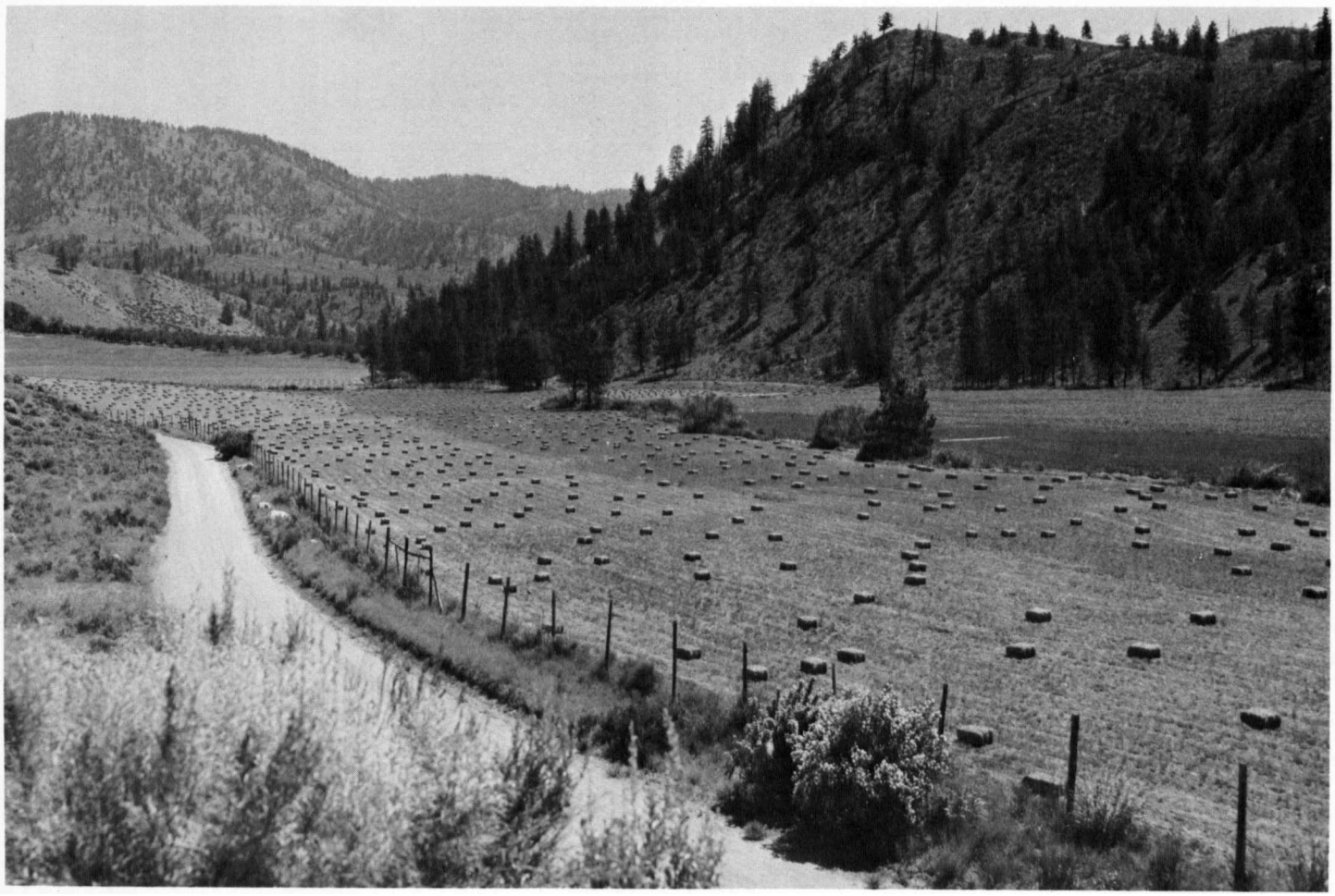
SOIL SURVEY OF

Okanogan County Area, Washington



United States Department of Agriculture
Soil Conservation Service
in cooperation with
Washington State University
Agriculture Research Center

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1971. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1971. This survey was made cooperatively by the Soil Conservation Service and the Washington State University Agriculture Research Center. It is part of the technical assistance furnished to the South Okanogan and North Okanogan Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the stability of tracts of land for farming, woodland, range, industry, and recreation.

Locating Soils

All the soils of Okanogan County Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in numerical order by map symbol and gives the capability classification of each. It also shows the page where each soil is described, and the page for the range site to which the soil has been assigned.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the orchard groups, the range sites, and the woodland suitability groups.

Foresters and others can refer to the section "Woodland," where productivity, management hazards, and plant associations of soils in the area are given.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the Okanogan County Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover: Baled alfalfa-grass hay grown under sprinkler irrigation on Conconully loam.

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Issued July 1980

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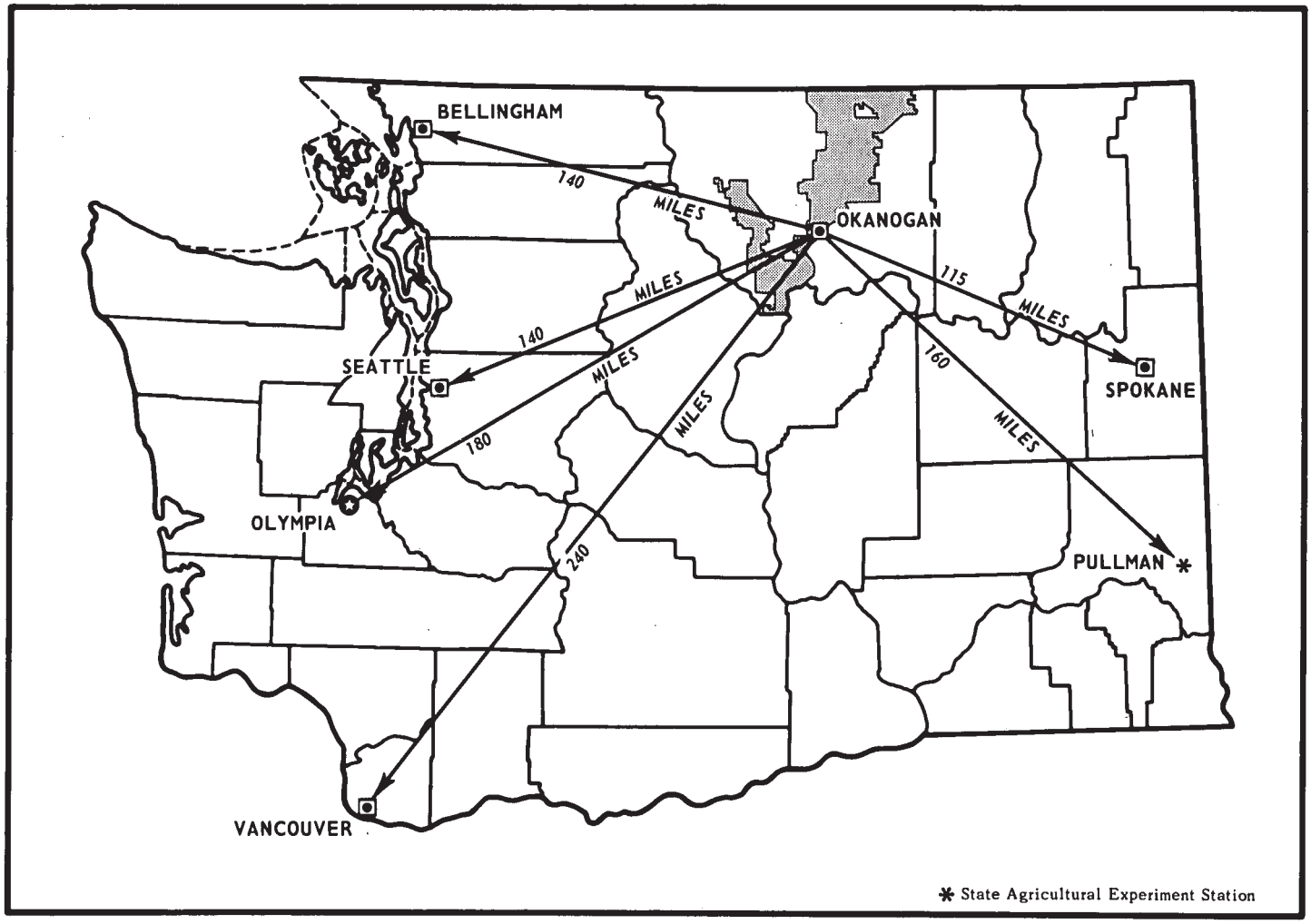

Location of Okanogan County Area in Washington.

SOIL SURVEY OF OKANOGAN COUNTY AREA, WASHINGTON

By Charles D. Lenfesty, Soil Conservation Service

Fieldwork by Charles D. Lenfesty, Jack W. Rogers, Dale E. Snyder, and Gerald J. Latshaw, Soil Conservation Service [1]

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Washington State University Agriculture Research Center

THE OKANOGAN COUNTY AREA is approximately one quarter of Okanogan County. It is in the northern part of Washington bordering British Columbia, Canada (see facing page). The area surveyed makes up 877,017 acres, or about 1,370 square miles. It is an area of diverse topography, geology, climate, and agriculture. Elevations range from about 750 feet where the Columbia River leaves the Area, to over 5,400 feet in the Buckhorn Mountains in the northeastern part.

The Area is drained by two principal streams—the Okanogan River and the Methow River. All the drainage water ultimately flows into the Columbia River. The Okanogan is a slow flowing, meandering stream that drains the eastern part of the Area. A considerable part of its flow originates in Canada. The Methow River is a clear, fast flowing stream that drains the western part of the Area. Similkameen River and Bonaparte, Antoine, Tonasket, and Salmon Creeks flow into the Okanogan River. The Twisp and Chewack Rivers, Beaver Creek, and Gold Creek are the main tributaries of the Methow River. Okanogan County Area is well supplied with lakes at all elevations. The largest ones in the Area are Osoyoos, Palmer, and Conconully Lakes.

Pleistocene glaciation has scoured the entire Area. Its effects are seen in U-shaped valleys, rounded mountain tops, glacial outwash terraces along most of the main stream valleys, and glacial-lake deposits bordering the Columbia and Okanogan Rivers and their main side valleys.

About one-third of the Okanogan County Area is woodland. The rest is mainly range with some dryland cultivated areas on the higher terraces and plateaus. Narrow strips along the major streams and tributaries are irrigated and are used for orchards, hay, and pasture. The irrigated soils are nearly all of alluvial origin. Most of the wooded and range soils formed in glacial till and outwash that is mixed with volcanic ash in the surface layer.

The river valley between Pateros and Oroville should be a major fruit-producing area for many years. The climate is ideally suited to apple production.

How This Survey Was Made

Soil scientist made this survey to learn what kinds of soil are in the Okanogan County Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is usually named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Okanogan and Tonasket, for example, are the names of two soils series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Ewall loamy fine sand is one of several phases within the Ewall series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

A mapping unit consists of all areas shown on a soil map that are identified by a common symbol. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is

[1] Others who contributed to the survey are ALLEN S. ZULAUF, HERMAN R. GENTRY, and GERALD L. RICHARD, Soil Conservation Service.

nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit is shown on the soil map of Okanogan County Area: the soil complex.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Donavan-Rock outcrop complex is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous land types and are given descriptive names. Badland is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how the soils behave when used as a growing medium for native and domestic plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this failure to slow permeability or a high water table. They see that streets, road pavements, and foundations for houses crack on a given kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their study and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Okanogan County Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an Area, who want to compare different parts of an Area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey have been grouped into three general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations are described on the following pages.

Deep to Very Shallow Mostly Forest Soils and Rock Outcrop on Mountainous Uplands

This group of associations mostly occupies strongly sloping to very steep mountainous upland slopes, fans, and deeply dissected glacial plains. Elevation ranges from 1,900 to 5,000 feet. The average annual precipitation ranges from 14 to 22 inches, and the frost-free season is 90 to 130 days.

The four asssociations in this group make up about 30 percent of the survey area.

1. Rock outcrop-Nevine-Donavan association

Rock outcrop and deep, well drained soils

The soil association is on mountain uplands and toe slopes. The soils formed in a mantle of volcanic ash and the underlying glacial till. Elevations range from 2,000 to 4,500 feet. The ridges are gently rounded and the hillsides, cut by deep drainages, are steep. In parts of the association the soil is shallow, and bedrock is exposed. The annual precipitation is 15 to 22 inches. The frost-free season is 90 to 120 days. The dominant vegetation is Douglas-fir, ponderosa pine, larch, lodgepole pine, and pinegrass.

This association makes up 3 percent of the Area. It is 30 percent granitic Rock outcrop interspersed with very shallow soils, 30 percent Nevine soils, 25 percent Donavan soils, and 15 percent Merkel, Molson, Kartar, Karamin, Lithic Xerochrepts, and Leader soils.

Nevine soils are well drained. They have a thin gray silt loam surface layer, a brown and yellowish brown silt loam subsoil, and a light brownish gray gravelly sandy loam substratum. They occur mostly on north-facing slopes.

The well drained Donavan soils have a grayish brown loam surface layer. The subsoil and the upper part of the substratum are pale brown and light gray silt loam. The lower part of the substratum is light gray gravelly sandy loam.

Figure 1.—Native range of rough fescue and bluebunch wheatgrass on Molson-Lithic Xerochrepts-Koepke association.

This association is used for woodland, grazed woodland, watershed, recreation, and wildlife.

2. *Molson-Lithic Xerochrepts-Koepke association*

Deep, shallow, and very shallow, well drained soils

This soil association is on deeply dissected glacial plains. The soils formed in a mantle of volcanic ash, underlying glacial till, and materials weathered from granite. Elevations range from 1,900 to 5,000 feet. The ridges are gently rounded, and the hillsides, which are cut by deep drainageways, are steep. In parts of the association the soil is shallow and very shallow, the dissected drainageways are shallow and sides are less steep, and the ridges are more undulating. The annual precipitation is 14 to 18 inches, and the frost-free season is 95 to 130 days. Bluebunch wheatgrass (fig. 1), Idaho fescue, rough fescue, and ponderosa pine is the dominant native vegetation. In drainageways, scattered Douglas-fir are on the sides, and clumps of aspen and cottonwood are in the bottoms. North-facing slopes generally have dense stands of timber.

This association makes up 25 percent of the Area. It is 50 percent Molson soils, 20 percent Lithic Xerochrepts, 20 percent Koepke soils, and 10 percent Hunters, Hum, Havillah, Leavenworth, and Vallan soils and Rock outcrop.

Molson soils are well drained. They have a very dark grayish brown silt loam surface layer and a yellowish brown gravelly silt loam subsoil. The substratum is light gray gravelly silt loam and gravelly loam.

Lithic Xerochrepts are well drained. In most places they are stony loam 5 to 20 inches deep over bedrock.

Koepke soils are well drained. They have a very dark gray and very dark grayish-brown silt loam surface layer over light gray gravelly loam underlying material.

This association is used for dryland crops, range, woodland, and wildlife.

3. *Republic-Mires-Chesaw association*

Deep, well drained and somewhat excessively drained soils

This soil association is on alluvial fans, outwash terraces, and escarpments. The soils formed in glacial till, reworked glacial till, and outwash. Elevations range from 2,800 to 4,500 feet. The annual precipitation is 14 to 18 inches. The frost-free season is 95 to 120 days. The dominant vegetation is bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, and scattered ponderosa pine. Some north-facing slopes are densely timbered.

This association makes up 1 percent of the Area. It is 55 percent Republic soils, 20 percent Mires soils, 20

percent Chesaw soils, and 5 percent Molson, Havillah, Hunters, and Leavenworth soils and Rock outcrop.

Republic soils are well drained. They have a dark gray loam surface layer and a grayish brown and pale brown gravelly sandy loam subsoil and upper substratum. The lower substratum is pale brown and light yellowish brown gravelly loamy sand.

Mires soils are well drained. They have a dark gray and dark grayish brown loam surface layer, a brown gravelly sandy loam subsoil, and a brown gravelly loamy sand and very gravelly sand substratum.

Chesaw soils are somewhat excessively drained. They have an extremely stony or gravelly sandy loam surface layer over very gravelly loamy sand and very gravelly sand.

This association is used for range, woodland, dryland crops, and wildlife.

4. *Rock outcrop-Donavan association*

Rock outcrop and deep, well drained soils

This association is on steep breaks of the deeply dissected glacial plains. The soils formed in volcanic ash over glacial till. Elevations range from 2,000 to 3,500 feet. Annual precipitation is 15 to 18 inches, and the frost-free season is 100 to 120 days. In the Donavan part of this association, the dominant vegetation is ponderosa pine, Douglas-fir, pinegrass, bluebunch wheatgrass, and Idaho fescue.

This association makes up 1 percent of the Area. It is about 70 percent Rock outcrop and 30 percent Donavan soils.

Rock outcrop is mostly granitic. It is interspersed with very shallow soils. The well drained Donavan soils have a grayish brown extremely stony loam or loam surface layer. The subsoil and upper part of the substratum are pale brown and light gray silt loam. The lower part of the substratum is light gray gravelly sandy loam.

This association is used mainly for woodland, grazed woodland, watershed, recreation, and wildlife.

Deep to Very Shallow Mostly Grassland Soils, Rock Outcrop and Badland on Dissected Upland Plains and Terraces

This group of associations occupies terraces and terrace escarpments, ridges, hillsides, and glacial till plains. Elevation ranges from 700 to 3,000 feet. The average annual precipitation ranges from 8 to 18 inches, and the frost-free season is 110 to 180 days.

The seven associations in this group make up about 60 percent of the survey area.

5. *Nighthawk-Conconully-Lithic Xerochrepts association*

Deep, shallow, and very shallow, well drained soils

This soil association is on a glacial till plain. The soils formed in glacial till and materials weathered from granite. Elevations range from 700 to 3,000 feet. Most of the association is on ridges and hillsides rising above the Cashmont soils of the Pogue-Cashmont-Cashmere association. The ridges are gently rounded and the hillsides are steep. In parts of the association the glacial till mantle is thin, and rock crops out. In areas of thin glacial till the drainageways are shallow and sides are less steep, and ridges are more undulating. The annual precipitation is 8 to 15 inches, and the frost-free season is 130 to 180 days. The dominant vegetation is big sagebrush and bluebunch wheatgrass. In drainageways, scattered ponderosa pine occurs on the side slopes and clumps of cottonwood are in the bottoms. Some north-facing slopes are wooded.

This association makes up 10 percent of the Area. It is 55 percent Nighthawk soils, 20 percent Conconully soils, 20 percent Lithic Xerochrepts, and 5 percent Newbon, Haley, Owhi, Nespelem, Synarep, and Colville soils and Rock outcrop.

The well drained Nighthawk soils have a grayish brown, extremely stony loam or loam surface layer, a brown gravelly loam and pale yellow very gravelly loam subsoil, and a very gravelly coarse sandy loam substratum.

Conconully soils are well drained. They have a dark grayish brown extremely stony loam surface layer in most places, a brown and pale brown gravelly fine sandy loam and gravelly sandy loam subsoil, and a light brownish gray gravelly sandy loam substratum.

Lithic Xerochrepts are well drained. In most places these soils are stony loam only 5 to 20 inches deep over bedrock.

Most of this association is used for range. Some small areas on alluvial fans and toe slopes are irrigated and are used for orchards and hay. Small areas that are nearly level to moderately steep are used for dryland hay, pasture, and small grain.

6. *Disautel-Conconully-Nespelem association*

Deep, well drained soils

This soil association is on plains and terraces. The soils formed in glacial till and lacustrine sediments. Elevations range from 1,500 to 3,000 feet. The upland plains are undulating and rolling, and the terraces and their escarpments are nearly level and strongly sloping. In parts of this association the glacial till is thin, and rock crops out. The annual precipitation is 11 to 15 inches. The frost-free season is 120 to 150 days. The dominant vegetation is big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, and scattered ponderosa pine.

This association makes up 8 percent of the Area. It is 50 percent Disautel soils, 15 percent Conconully soils, 15 percent Nespelem soils, and 20 percent Haley, Hodgson, Owhi, and Synarep soils and Rock outcrop.

Disautel soils are well drained. They have a grayish brown silt loam surface layer, a pale brown loam subsoil, and a light gray gravelly loam substratum.

The well drained Conconully soils have a dark grayish brown extremely stony loam surface layer in most places. The subsoil is brown and pale brown gravelly fine sandy loam and gravelly sandy loam. The substratum is light brownish gray gravelly sandy loam.

Nespelem soils are mainly well drained. They have a grayish brown silt loam surface layer, a pale brown silt loam subsoil, and a light gray silt loam substratum. Erosion has exposed the highly erodible lacustrine sediments in some places.

This association is used for dryland crops, range, woodland, and some irrigated crops.

7. *Conconully-Lithic Xerochrepts-Haley association*

Deep, shallow, and very shallow, well drained soils

This association is on plains and terraces. The soils formed in glacial till and outwash and materials weathered from granite. Elevations are 1,400 to 3,000 feet. The dissected plains form undulating and rolling uplands and steep hillsides. The terraces and their escarpments are nearly level to strongly sloping. In parts of the association the soil is shallow and is intermingled with Rock outcrop. The drainageways in these areas have less steep side slopes and more undulating ridges. The annual precipitation is 11 to 15 inches, and the frost-free season is 130 to 150 days. The dominant vegetation is big sagebrush and bluebunch wheatgrass. In drainageways, scattered ponderosa pine occurs on the side slopes.

This association makes up 15 percent of the Area. It is 60 percent Conconully soils, 20 percent Lithic Xerochrepts, 15 percent Haley soils, and 5 percent Owhi, Disautel, Nespelem, Synarep, and Emdent soils and Rock outcrop.

The deep, well drained Conconully soils formed in glacial till. They have a dark grayish brown gravelly sandy loam or loam surface layer, a brown and pale brown gravelly fine sandy loam and gravelly sandy loam subsoil, and a light brownish gray gravelly sandy loam substratum.

Lithic Xerochrepts are well drained. In most places, they are stony loam only 5 to 20 inches deep over bedrock.

The well drained Haley soils have a dark grayish brown and grayish brown fine sandy loam surface layer, a pale brown fine sandy loam subsoil, and a light brownish gray sand substratum.

Parts of this association are used for irrigated orchards and forage. They are also used for dryland crops, range, and woodland.

8. *Newbon-Conconully association*

Deep, well drained soils

This soil association is on glacial till plains. The soils formed in glacial till. Elevations range from 1,500 to 3,000 feet. The dissected plains form undulating and rolling uplands and steep hillsides. In parts of this association, the soil mantle is shallow and is intermingled with Rock outcrop. In areas where the soil mantle is shallow the drainageways are shallow and sides are less steep, and the uplands are more undulating. The annual precipitation is 11 to 15 inches, and the frost-free season is 130 to 150 days. The dominant vegetation is big sagebrush, Sandberg bluegrass, and bluebunch wheatgrass. In drainageways scattered ponderosa pine is on the side slopes, and clumps of aspen are in the bottoms. North-facing slopes are mostly wooded.

This association makes up 15 percent of the Area. It is 50 percent Newbon soils, 30 percent Conconully soils, and 20 percent Haley and Owhi soils and Rock outcrop.

Newbon soils are well drained. They have a dark grayish brown gravelly loam surface layer in most places, a brown gravelly loam subsoil, and a light brownish gray gravelly loam substratum.

The well drained Conconully soils have a dark grayish brown gravelly sandy loam, loam, or extremely stony loam surface layer, a brown and pale brown gravelly fine sandy loam subsoil, and a light brownish gray gravelly sandy loam substratum.

Most of this association is used for range. Small areas on alluvial fans and toe slopes are irrigated and used for orchards, alfalfa, and grass hay. Small areas are also used for dryland crops.

9. *Kartar-Dinkelman-Springdale association*

Deep, well drained and somewhat excessively drained soils

This soil association is on plains and outwash terraces and steep uplands. The soils formed in glacial till outwash and material weathered from granite, gneiss, and schist. Elevations range from 2,000 to 3,500 feet. The deeply dissected plains form long, narrow to broad, gently rounded ridges and long, steep side slopes. The terraces and their escarpments are nearly level and strongly sloping. In parts of the association the soil mantle is shallow and intermingled with Rock outcrop. The annual precipitation is 14 to 18 inches, and the frost-free season is 100 to 120 days. The dominant vegetation is ponderosa pine (fig. 2), Douglas-fir, larch, Idaho fescue, bluebunch wheatgrass, and pinegrass.

This association makes up 8 percent of the Area. It is 50 percent Kartar soils, 20 percent Dinkelman soils, 10 percent Springdale soils, and 20 percent Donavan, Leader, Merkel, and Wadams soils and Rock outcrop.

The well drained Kartar soils have a light brownish gray extremely stony sandy loam surface layer in most places, a pale brown sandy loam and gravelly sandy loam subsoil, and a very pale brown gravelly loamy sand and very gravelly sand substratum.

Dinkelman soils are well drained. They have a grayish brown sandy loam surface layer and a pale brown fine sandy loam and pale brown gravelly fine sandy loam subsoil.

Springdale soils are somewhat excessively drained. They have a dark gray and dark grayish brown sandy loam surface layer over pale brown gravelly sandy loam and very gravelly sand.

This association is used mainly for woodland, grazed woodland, and range. Small areas have been cleared and are used for dryland and irrigated crops.

10. *Owhi-Winthrop association*

Deep, well drained and excessively drained soils

This soil association is on nearly level and strongly sloping terraces and their escarpments. The soils formed in glacial outwash and alluvium. Elevations range from 1,400 to 3,000 feet. The annual precipitation is 11 to 15 inches, and the frost-free season is 110 to 150 days. The dominant vegetation is bluebunch wheatgrass, bitterbrush, big sagebrush, and some stands of ponderosa pine.

This association makes up 3 percent of the Area. It is 60 percent Owhi soils, 20 percent Winthrop soils and 20 percent Haley, Leavenworth, and Boesel soils.

Owhi soils are well drained. They have a grayish brown fine sandy loam surface layer, a grayish brown and brown sandy loam and gravelly sandy loam sub-

Figure 2.—South exposure on Kartar-Dinkelman-Springdale association.

soil and upper substratum, and a very gravelly coarse sand lower substratum.

Winthrop soils are excessively drained. They have a dark grayish brown and grayish brown gravelly loamy sand and extremely stony loamy sand surface layer underlain by brown gravelly loamy sand and very gravelly sand.

Some areas of this association are used for irrigated orchards, forage, and row crops. Some areas are used for grazing and dryland small grain (fig. 3). Other uses are range and woodland.

11. Badland-Rock outcrop association

Nearly barren severely eroded areas and Rock outcrop

This association of steep escarpments consists of nearly barren severely eroded areas and Rock outcrop. Elevations range from 1,500 to 3,000 feet. The annual precipitation is 8 to 14 inches, and the frost-free season is 130 to 150 days. The scattered sparse vegetation is ponderosa pine and bluebunch wheatgrass.

This association makes up 1 percent of the Area. It is about 50 percent Rock outcrop and 50 percent Badland.

Rock outcrop is mostly granitic. About 10 percent of the Rock outcrop area is undifferentiated soil material. Badland is highly eroded areas of exposed lake sediments and gravelly till.

This association is used mainly for wildlife and watershed.

Deep, Mostly Grassland and Meadow Soils on Terraces and Flood Plains

This group of associations occupies alluvial bottoms, basins, depressions, and terraces. Elevation ranges from 70 to 2,000 feet. The average annual precipitation ranges from 8 to 14 inches, and the frost-free season is 145 to 180 days.

The two associations in this group make up about 10 percent of the survey area.

12. Pogue-Cashmont-Cashmere association

Deep, somewhat excessively drained and well drained soils

This soil association is on terraces. The soils formed in glacial till and outwash. Elevations are 700 to 1,500 feet. The annual precipitation is 8 to 12 inches. The frost-free season is about 145 to 180 days. The dominant vegetation is bluebunch wheatgrass, needleandthread, and big sagebrush.

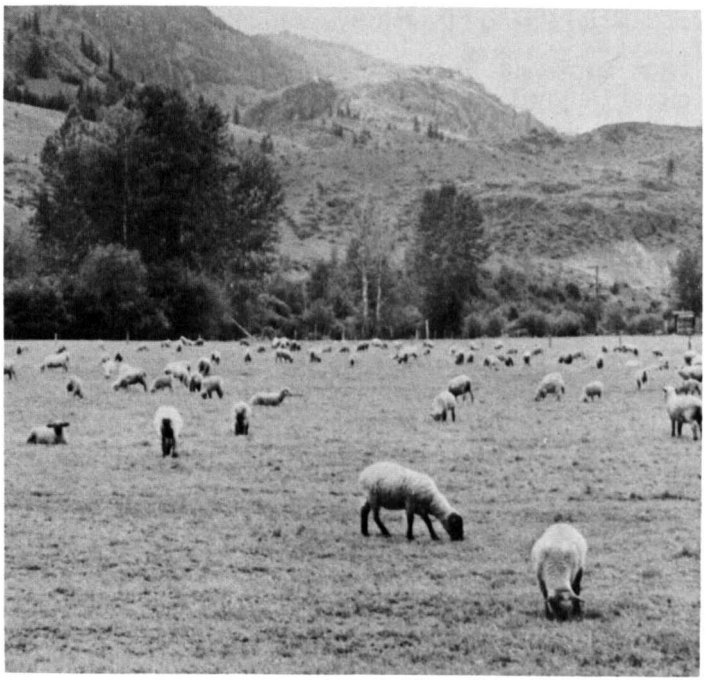

Figure 3.—**Pasture on Owhi-Winthrop association. Newbon-Conconully association is in the background.**

This association makes up 8 percent of the area. It is 35 percent Pogue soils, 25 percent Cashmont soils, 20 percent Cashmere soils, and 20 percent Aeneas, Ewall, Tonasket, and Skaha soils and about 2 percent Rock outcrop, which is intermingled with the soils that are shallow over bedrock.

Pogue soils are somewhat excessively drained. They have a grayish brown fine sandy loam surface layer. The subsoil is brown and yellowish brown fine sandy loam and gravelly fine sandy loam. The substratum is very gravelly sand.

The well drained Cashmont soils have a grayish brown sandy loam surface layer. The subsoil is brown gravelly sandy loam. The substratum is gravelly sandy loam.

Cashmere soils are well drained. They have a grayish brown fine sandy loam surface layer. The subsoil is brown sandy loam: The substratum is brown fine sandy loam and loamy fine sand.

This association is the principal orchard-growing area. Irrigation is of major importance. Nonirrigated areas are used chiefly for range. Some are used for dryland crops.

13. Colville-Okanogan association

Deep, somewhat poorly drained and well drained soils

This soil association is on flood plains and is subject to spring flooding. The soils formed in alluvium. Elevations range from 700 to 2,000 feet. Annual precipitation is 8 to 14 inches, and the frost-free season is 145 to 180 days. The dominant vegetation in the more moist areas is water-tolerant plants such as willows, aspen, cottonwood, sedges, and rushes. Bluebunch wheatgrass, basin wildrye, big sagebrush, and saltgrass are prevalent in the drier areas.

This association makes up 2 percent of the Area. It is 70 percent Colville soils, 20 percent Okanogan soils, and 10 percent Synarep soils and Xerofluvents, wet.

Colville soils are somewhat poorly drained. They have a dark gray silt loam and silty clay loam surface layer, a mottled light gray silt loam and silty clay loam subsoil, and a mottled light gray and a pale brown silty clay loam substratum.

The well drained Okanogan soils have a dark grayish brown surface layer. The underlying material is brown and light brownish gray stratified loam, silt loam, and sandy loam. Below a depth of 40 inches, it is very gravelly sand in places.

In areas protected from flooding, this association is used for irrigated orchards, hay, and pasture. Areas subject to flooding are used for native hay and pasture or short growing season crops, such as silage.

Descriptions of the Soils

This section describes the soils series and mapping units in the Okanogan County Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rock outcrop and Riverwash, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a numeral that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, orchard group, and woodland suitability subclass to which the mapping unit has been assigned. The page for the description of each capability unit, orchard group, and range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil map-

ping can be obtained from the Soil Survey Manual (7).[2]

Aeneas Series

The Aeneas series consists of deep, well drained soils underlain by sand. These nearly level to strongly sloping soils are on terraces and alluvial bottoms at elevations of 700 to 1,500 feet. They formed in glacial outwash. The native vegetation is mainly bluebunch wheatgrass, needleandthread, and big sagebrush. The mean annual precipitation is 8 to 11 inches, the mean annual air temperature is about 49° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown fine sandy loam about 8 inches thick. The subsoil is brown fine sandy loam about 8 inches thick. The substratum is yellowish brown fine sandy loam about 10 inches thick over unconformable loamy sand and sand that extends to 60 inches or more.

Permeability is moderately rapid to a depth of about 26 inches and very rapid below. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Aeneas soils are used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops and grazing.

Representative profile of Aeneas fine sandy loam, 0 to 3 percent slopes, in area of native range about 75 feet west and 50 feet north of southeast corner of SE¼NE¼ sec. 20, T. 31 N., R. 25 E.

A11—0 to 2 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; neutral; abrupt smooth boundary.

A12—2 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak coarse granular structure; soft, very friable, nonsticky, nonplastic; common roots; many very fine pores; neutral; clear smooth boundary.

B2—8 to 16 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak coarse prismatic structure; soft, very friable, nonsticky, nonplastic; common very fine roots; few fine pores; neutral; clear smooth boundary.

C1—16 to 26 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) when moist; massive; soft, very friable, nonsticky, nonplastic; few roots; few very fine pores; neutral; gradual smooth boundary.

IIC2—26 to 30 inches; light yellowish brown (10YR 6/4) loamy sand, dark yellowish brown (10YR 4/4) when moist; single grained; loose when dry and moist; neutral; abrupt wavy boundary.

IIC3—30 to 60 inches; multicolored sand.

Depth to the unconformable sandy material ranges from 21 to 36 inches. Texture of the A horizon is either sandy loam or fine sandy loam. In some places the IIC horizon contains lenses of gravel less than 6 inches thick.

1—Aeneas fine sandy loam, 0 to 3 percent slopes. This soil has the profile described as representative of the series. As much as 10 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam and Ewall loamy fine sand. Also included are a few small areas where slopes are greater than 3 percent.

Runoff is very slow, and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops and grazing. Capability unit IVe–3 dryland, IIe–1 irrigated; orchard group 2; range site 3.

2—Aeneas fine sandy loam, 3 to 8 percent slopes. As much as 10 percent of some mapped areas of this soil is included tracts of Cashmere fine sandy loam and Ewall loamy fine sand. Also included are small areas of short steep terrace escarpments and a few small areas where slopes are less than 3 percent.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, and pasture. Small areas are used for grazing and dryland crops. Capability unit IVe–3 dryland, IIIe–1 irrigated; orchard group 2; range site 3.

3—Aeneas fine sandy loam, 8 to 15 percent slopes. As much as 10 percent of the total acreage of this soil is included areas of Cashmere fine sandy loam and Ewall loamy fine sand. Also included are a few small areas with slopes greater than 15 percent and small eroded spots.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for irrigated orchards. Small areas are used for grazing and dryland crops. Capability unit IVe–3 dryland, IVe–1 irrigated; orchard group 2; range site 3.

Badland

4—Badland consists mainly of areas of steep and very steep gravelly till and silty lake sediments broken by numerous intermittent drainageways. It supports little or no vegetation. Shallow gullies and small, smooth ridges form an intricate pattern in many places.

Runoff is very rapid, and the hazard of erosion is very high.

Badland has practically no agricultural value and is used mainly for wildlife and watershed. Capability unit VIIIe–1 dryland.

Boesel Series

The Boesel series consists of deep, moderately well drained soils underlain by sand and gravel. These nearly level soils are on stream terraces at elevations of 1,500 to 3,000 feet. They formed in alluvium. The native vegetation is mainly ponderosa pine, Douglas-

[2] Italic numbers in parentheses refer to Literature Cited, p. 150.

TABLE 1.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
1	Aeneas fine sandy loam, 0 to 3 percent slopes	2,021	0.2
2	Aeneas fine sandy loam, 3 to 8 percent slopes	795	0.1
3	Aeneas fine sandy loam, 8 to 15 percent slopes	357	(1)
4	Badland	4,058	0.5
5	Boesel fine sandy loam	3,489	0.4
6	Boesel silt loam, heavy subsoil variant	1,910	0.2
7	Cashmere fine sandy loam, 0 to 3 percent slopes	5,663	0.6
8	Cashmere fine sandy loam, 3 to 8 percent slopes	3,765	0.4
9	Cashmere fine sandy loam, 8 to 15 percent slopes	1,408	0.2
10	Cashmere fine sandy loam, 15 to 25 percent slopes	527	0.1
11	Cashmere fine sandy loam, 25 to 65 percent slopes	332	(1)
12	Cashmont sandy loam, 0 to 3 percent slopes	474	0.1
13	Cashmont sandy loam, 3 to 8 percent slopes	3,794	0.4
14	Cashmont sandy loam, 8 to 15 percent slopes	3,218	0.4
15	Cashmont sandy loam, 15 to 25 percent slopes	1,417	0.2
16	Cashmont gravelly sandy loam, 0 to 8 percent slopes	574	0.1
17	Cashmont gravelly sandy loam, 8 to 15 percent slopes	454	0.1
18	Cashmont very gravelly sandy loam, 3 to 25 percent slopes	348	(1)
19	Cashmont extremely stony sandy loam, 0 to 25 percent slopes	11,048	1.3
20	Cashmont extremely stony sandy loam, 25 to 45 percent slopes	10,961	1.2
21	Chesaw gravelly sandy loam, 15 to 45 percent slopes	2,152	0.2
22	Chesaw extremely stony sandy loam, 15 to 45 percent slopes	715	0.1
23	Colville silt loam	7,919	0.9
24	Colville silt loam, moderately wet	2,497	0.3
25	Conconully gravelly sandy loam, 3 to 8 percent slopes	842	0.1
26	Conconully gravelly sandy loam, 8 to 25 percent slopes	2,025	0.2
27	Conconully loam, 0 to 8 percent slopes	9,753	1.1
28	Conconully loam, 8 to 15 percent slopes	14,645	1.7
29	Conconully loam, 15 to 25 percent slopes	7,206	0.8
30	Conconully extremely stony loam, 0 to 25 percent slopes	41,049	4.7
31	Conconully extremely stony loam, 25 to 65 percent slopes	20,456	2.3
32	Conconully extremely stony loam, 25 to 65 percent north slopes	11,893	1.4
33	Dinkelman sandy loam, 0 to 25 percent slopes	2,175	0.2
34	Dinkelman sandy loam, 25 to 65 percent slopes	1,634	0.2
35	Dinkelman gravelly sandy loam, 3 to 25 percent slopes	728	0.1
36	Dinkelman extremely stony sandy loam, 0 to 25 percent slopes	2,514	0.3
37	Dinkelman extremely stony sandy loam, 25 to 65 percent slopes	7,125	0.8
38	Dinkelman loam, 25 to 45 percent slopes	1,956	0.2
39	Disautel silt loam, 0 to 8 percent slopes	1,247	0.1
40	Disautel silt loam, 8 to 15 percent slopes	2,254	0.3
41	Disautel silt loam, 15 to 25 percent slopes	459	0.1
42	Disautel very cobbly silt loam, 8 to 45 percent slopes, eroded	2,830	0.3
43	Disautel extremely stony silt loam, 0 to 25 percent slopes	2,844	0.3
44	Disautel extremely stony silt loam, 25 to 65 percent slopes	1,805	0.2
45	Donavan loam, 3 to 8 percent slopes	1,089	0.1
46	Donavan loam, 8 to 25 percent slopes	4,245	0.5
47	Donavan loam, 25 to 65 percent slopes	1,612	0.2
48	Donavan extremely stony loam, 0 to 25 percent slopes	4,776	0.5
49	Donavan extremely stony loam, 25 to 65 percent slopes	4,048	0.5
50	Donavan-Rock outcrop complex, 25 to 65 percent slopes	20,941	2.4
51	Emdent loam	1,283	0.1
52	Ewall sand, 0 to 15 percent slopes	2,981	0.3
53	Ewall loamy fine sand, 0 to 15 percent slopes	8,375	1.0
54	Ewall loamy fine sand, 15 to 25 percent slopes	2,416	0.3
55	Ewall loamy fine sand, 25 to 45 percent slopes	1,535	0.2
56	Haley fine sandy loam, 0 to 8 percent slopes	3,199	0.4
57	Haley fine sandy loam, 8 to 25 percent slopes	931	0.1
58	Haley fine sandy loam, 25 to 45 percent slopes	454	0.1
59	Havillah silt loam, 0 to 8 percent slopes	2,810	0.3
60	Havillah silt loam, 8 to 15 percent slopes	2,249	0.3
61	Havillah silt loam, 15 to 25 percent slopes	1,672	0.2
62	Havillah silt loam, 15 to 45 percent slodes, eroded	887	0.1
63	Havillah extremely stony silt loam, 15 to 45 percent slopes	928	0.1
64	Hodgson silt loam, 3 to 15 percent slopes	2,086	0.2
65	Hum silt loam, 8 to 20 percent slopes	889	0.1
66	Hunters silt loam, 0 to 8 percent slopes	2,219	0.3
67	Hunters silt loam, 8 to 15 percent slopes	920	0.1
68	Hunters silt loam, 8 to 25 percent slopes, eroded	657	0.1
69	Hunters silt loam, 25 to 45 percent slopes	388	(1)
70	Karamin sandy loam, 8 to 25 percent slopes	990	0.1
71	Kartar sandy loam, 3 to 15 percent slopes	2,686	0.3
72	Kartar sandy loam, 15 to 25 percent slopes	1,028	0.1
73	Kartar sandy loam, 15 to 45 percent north slopes	9,861	1.1
74	Kartar extremely stony sandy loam, 0 to 25 percent slopes	13,114	1.5
75	Kartar extremely stony sandy loam, 25 to 65 percent slopes	17,748	2.0
76	Koepke silt loam, 0 to 8 percent slopes	3,514	0.4
77	Koepke silt loam, 8 to 15 percent slopes	7,889	0.9

TABLE 1.—*Acreage and proportionate extent of the soils*—Continued

Map symbol	Soil name	Acres	Percent
78	Koepke silt loam, 15 to 25 percent slopes	5,468	0.6
79	Koepke silt loam, 25 to 45 percent slopes	3,414	0.4
80	Koepke gravelly silt loam, 3 to 25 percent slopes	663	0.1
81	Leader fine sandy loam, 0 to 8 percent slopes	1,447	0.2
82	Leader fine sandy loam, 8 to 25 percent slopes	1,278	0.1
83	Leader fine sandy loam, 25 to 45 percent slopes	726	0.1
84	Leavenworth silt loam	2,492	0.3
85	Lithic Xerochrepts-Cashmont complex, 15 to 45 percent slopes	23,339	2.7
86	Lithic Xerochrepts-Conconully complex, 15 to 45 percent slopes	62,619	7.1
87	Lithic Xerochrepts-Donavan-Rock outcrop complex, 15 to 45 percent slopes	33,275	3.8
88	Lithic Xerochrepts-Hum complex, 0 to 45 percent slopes	1,191	0.1
89	Lithic Xerochrepts-Kartar complex, 15 to 45 percent slopes	11,932	1.4
90	Lithic Xerochrepts-Molson complex, 15 to 45 percent slopes	29,979	3.4
91	Lithic Xerochrepts-Nevine complex, 15 to 45 percent slopes	6,398	0.7
92	Lithic Xerochrepts-Newbon complex, 15 to 45 percent slopes	7,039	0.8
93	Lithic Xerochrepts-Nighthawk complex, 15 to 45 percent slopes	7,195	0.8
94	Lithic Xerochrepts-Republic complex, 15 to 45 percent slopes	964	0.1
95	Lithic Xerochrepts-Vallan complex, 15 to 45 percent slopes	22,212	2.5
96	Lithic Xerochrepts-Wadams complex, 25 to 65 percent slopes	734	0.1
97	Marsh	722	0.1
98	Merkel sandy loam, 0 to 25 percent slopes	1,656	0.2
99	Merkel extremely stony sandy loam, 3 to 25 percent slopes	350	(1)
100	Merkel extremely stony sandy loam, 25 to 65 percent slopes	882	0.1
101	Mires gravelly sandy loam, 25 to 45 percent slopes	604	0.1
102	Mires extremely stony sandy loam, 15 to 65 percent slopes	505	0.1
103	Mires loam, 0 to 8 percent slopes	2,461	0.3
104	Mires gravelly loam, 3 to 25 percent slopes	1,425	0.2
105	Molson silt loam, 0 to 8 percent slopes	2,923	0.3
106	Molson silt loam, 8 to 15 percent slopes	9,976	1.1
107	Molson silt loam, 15 to 25 percent slopes	6,052	0.7
108	Molson silt loam, 25 to 45 percent slopes	2,612	0.3
109	Molson gravelly silt loam, 3 to 25 percent slopes	3,113	0.4
110	Molson extremely stony silt loam, 8 to 25 percent slopes	6,279	0.7
111	Molson extremely stony silt loam, 25 to 45 percent slopes	10,913	1.2
112	Nespelem silt loam, 3 to 8 percent slopes	2,792	0.3
113	Nespelem silt loam, 8 to 15 percent slopes	1,132	0.1
114	Nespelem silt loam, 15 to 25 percent slopes	257	(1)
115	Nespelem silt loam, 8 to 25 percent slopes, eroded	510	0.1
116	Nespelem silt loam, 25 to 45 percent slopes	258	(1)
117	Nespelem silt loam, alkali, 0 to 3 percent slopes	757	0.1
118	Nevine silt loam, 8 to 25 percent slopes	10,226	1.2
119	Nevine silt loam, 25 to 45 percent slopes	7,258	0.8
120	Nevine extremely stony silt loam, 0 to 25 percent slopes	1,225	0.1
121	Nevine extremely stony silt loam, 25 to 65 percent slopes	3,553	0.4
122	Newbon loam, 3 to 8 percent slopes	2,138	0.2
123	Newbon loam, 8 to 15 percent slopes	3,157	0.4
124	Newbon loam, 15 to 25 percent slopes	1,592	0.2
125	Newbon gravelly loam, 0 to 8 percent slopes	1,478	0.2
126	Newbon gravelly loam, 8 to 25 percent slopes	4,704	0.5
127	Newbon gravelly loam, 25 to 45 percent slopes	26,467	3.0
128	Newbon gravelly loam, 25 to 45 percent north slopes	4,097	0.5
129	Newbon very gravelly loam, 25 to 65 percent slopes, eroded	17,546	2.0
130	Newbon extremely stony loam, 0 to 45 percent slopes	4,962	0.6
131	Nighthawk loam, 3 to 8 percent slopes	1,642	0.2
132	Nighthawk loam, 8 to 15 percent slopes	5,312	0.6
133	Nighthawk loam, 15 to 25 percent slopes	2,230	0.3
134	Nighthawk extremely stony loam, 8 to 25 percent slopes	3,850	0.4
135	Nighthawk extremely stony loam, 25 to 65 percent slopes	9,199	1.0
136	Nighthawk extremely stony loam, 25 to 65 percent slopes, eroded	2,676	0.3
137	Okanogan loam	2,497	0.3
138	Okanogan loam, gravelly substratum	633	0.1
139	Owhi fine sandy loam, 0 to 3 percent slopes	3,673	0.4
140	Owhi fine sandy loam, 3 to 8 percent slopes	2,013	0.2
141	Owhi gravelly fine sandy loam, 0 to 8 percent slopes	2,969	0.3
142	Owhi gravelly fine sandy loam, 8 to 25 percent slopes	462	0.1
143	Owhi extremely stony fine sandy loam, 0 to 25 percent slopes	4,758	0.5
144	Owhi extremely stony fine sandy loam, 25 to 45 percent slopes	4,964	0.6
145	Pogue fine sandy loam, 0 to 3 percent slopes	12,119	1.4
146	Pogue fine sandy loam, 3 to 8 percent slopes	6,108	0.7
147	Pogue fine sandy loam, 8 to 15 percent slopes	2,108	0.2
148	Pogue fine sandy loam, 15 to 25 percent slopes	1,305	0.1
149	Pogue gravelly fine sandy loam, 0 to 8 percent slopes	2,513	0.3
150	Pogue gravelly fine sandy loam, 8 to 25 percent slopes	1,945	0.2
151	Pogue extremely stony fine sandy loam, 0 to 25 percent slopes	8,892	1.0
152	Pogue extremely stony fine sandy loam, 25 to 65 percent slopes	12,393	1.4
153	Republic gravelly sandy loam, 3 to 15 percent slopes	1,558	0.2

TABLE 1.—*Acreage and proportionate extent of the soils*—Continued

Map symbol	Soil name	Acres	Percent	Map symbol	Soil name	Acres	Percent
154	Republic gravelly sandy loam, 15 to 25 percent slopes	461	0.1	170	Springdale extremely stony sandy loam, 0 to 25 percent slopes	2,814	0.3
155	Republic extremely stony sandy loam, 15 to 45 percent slopes	2,656	0.3	171	Springdale extremely stony sandy loam, 25 to 45 percent slopes	2,208	0.3
156	Republic loam, 0 to 8 percent slopes	863	0.1	172	Synarep silt loam	3,725	0.4
157	Republic loam, 8 to 15 percent slopes	1,762	0.2	173	Tonasket silt loam, 0 to 3 percent slopes	1,972	0.2
158	Republic loam, 15 to 25 percent slopes	1,272	0.1	174	Tonasket silt loam, 3 to 8 percent slopes	1,476	0.2
159	Republic loam, 25 to 45 percent slopes	262	(1)	175	Tonasket silt loam, 8 to 15 percent slopes	1,329	0.2
160	Republic loam, gravelly substratum, 0 to 8 percent slopes	601	0.1	176	Tonasket silt loam, 15 to 25 percent slopes	713	0.1
161	Riverwash	3,739	0.4	177	Tonasket silt loam, 25 to 45 percent slopes	1,011	0.1
162	Rock outcrop	18,806	2.1	178	Tonasket extremely stony silt loam, 0 to 45 percent slopes	476	0.1
163	Skaha loamy sand, 0 to 8 percent slopes	1,926	0.2	179	Wadams sandy loam, 3 to 15 percent slopes	507	0.1
164	Skaha gravelly loamy sand, 0 to 15 percent slopes	1,111	0.1	180	Wadams extremely stony sandy loam, 0 to 25 percent slopes	580	0.1
165	Skaha gravelly loamy sand, 15 to 25 percent slopes	932	0.1	181	Wadams extremely stony sandy loam, 25 to 65 percent slopes	1,755	0.2
166	Skaha gravelly loamy sand, 25 to 65 percent slopes	1,986	0.2	182	Winthrop gravelly loamy sand, 0 to 15 percent slopes	4,010	0.5
167	Springdale sandy loam, 0 to 3 percent slopes	1,060	0.1	183	Winthrop extremely stony loamy sand, 0 to 45 percent slopes	1,934	0.2
168	Springdale sandy loam, 3 to 8 percent slopes	1,355	0.2	184	Xerofluvents, wet	841	0.1
169	Springdale sandy loam, 8 to 25 percent slopes	750	0.1		Water	13,602	1.6
					Total	877,017	100.0

[1] Less than 0.1 percent.

fir, snowberry, and serviceberry. The mean annual precipitation is 14 to 17 inches, the mean annual air temperature is about 42° F., and the frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish brown fine sandy loam about 8 inches thick. The underlying material is brown and light yellowish brown fine sandy loam about 19 inches thick over very gravelly sand that extends to 60 inches or more.

The seasonal high water table is at a depth of 3 to 4 feet. Permeability is moderate to a depth of about 27 inches and very rapid below 37 inches. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Boesel soils are used mainly for irrigated hay and pasture, woodland, and wildlife habitat. A small acreage is in dryland crops.

Representative profile of Boesel fine sandy loam, in area of woodland about 200 feet west and 200 feet north from SE1/16 corner SW1/4SW1/4 sec. 26, T. 35 N., R. 21 E.

A1—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 3/2) when moist; weak medium and fine granular structure; soft, very friable, nonsticky, slightly plastic; many roots; many very fine pores; neutral; abrupt smooth boundary.

AC—8 to 27 inches; brown (10YR 5/3) fine sandy loam, grayish brown (10YR 3/3) when moist; massive; slightly hard, very friable, nonsticky, slightly plastic; common roots; common medium and fine pores; neutral; clear wavy boundary.

IIC1—27 to 37 inches; light yellowish brown (10YR 6/4) loamy sand, dark yellowish brown (10YR 4/4) when moist; massive; soft, very friable, nonsticky, nonplastic; few roots; few fine pores; 5 percent gravel; neutral; abrupt wavy boundary.

IIC2—37 to 60 inches—multicolored very gravelly sand.

Depth to the unconformable sandy and gravelly materials ranges from 24 to 40 inches. Content of coarse fragments in the A and AC horizons is less than 10 percent. Texture of the A horizon is fine sandy loam or loam. In some places the IIC horizon has mottles in 7.5YR hue. The IIC2 horizon is normally very gravelly sand but may be stratified sand and gravel and contains thin strata of silty materials.

5—Boesel fine sandy loam. This nearly level soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this soil is included areas of Boesel silt loam, heavy subsoil variant; Xerofluvents, wet; and Springdale sandy loam. Also included are a few small areas where slopes are 3 to 8 percent.

Runoff is very slow, and the hazard of erosion none to slight. This soil is subject to flooding during spring runoff in years of high snowfall.

This soil is used mainly for irrigated hay, pasture, woodland, and wildlife habitat. A small acreage is in dryland crops. Capability unit IIIw–1 dryland, IIIw–1 irrigated; woodland suitability 2o.

Boesel Variant

The Boesel variant consists of deep, well drained soils formed in alluvium. These nearly level soils occupy low terraces and alluvial bottoms at elevations of 1,400 and 2,000 feet. The native vegetation is mainly ponderosa pine, serviceberry, and cottonwood. The mean annual precipitation is 11 to 17 inches, the mean annual air temperature is about 42° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is dark grayish brown silt loam about 7 inches thick. The upper 11 inches of the subsoil is brown silt loam. The lower 11 inches is yellowish brown silty clay loam. The substratum is pale brown gravelly loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Roots penetrate to 60 inches or more.

These soils are used mainly for irrigated orchards, hay and pasture, dryland crops, and woodland.

Representative profile of Boesel silt loam, heavy subsoil variant, in cultivated area about 350 feet north of junction of Harts Pass, Early Winters, and Winthrop roads and 50 feet west of Harts Pass road NW¼ SE¼SE¼ sec. 25, T. 36 N., R. 19 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate coarse granular structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; many very fine pores; slightly acid; clear smooth boundary.

B1—7 to 18 inches; brown (10YR 5/3) heavy silt loam, dark brown (10YR 3/3) when moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; common very fine pores; neutral; clear smooth boundary.

B2—18 to 28 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 3/4) when moist; moderate medium prismatic structure; hard, firm, sticky, plastic; few roots; many fine and very fine pores; slightly acid, gradual smooth boundary.

C—29 to 60 inches; pale brown (10YR 6/3) gravelly loam, brown to dark brown (10YR 4/3) when moist; massive; hard, firm, sticky, slightly plastic; few roots; many fine and very fine pores; 20 percent gravel; slightly acid.

Texture of the A horizon is loam or silt loam. Texture of the B horizon ranges from loam to silty clay loam. Texture of the C horizon ranges from gravelly loam to silt loam that is up to 25 percent gravel. In some places there are thin discontinuous strata of sand in the C horizons.

6—Boesel silt loam, heavy subsoil variant. This nearly level soil has the profile described as representative of the variant. As much as 15 percent of the total acreage of this mapping unit is included areas of Boesel fine sandy loam and Xerofluvents, wet.

Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used mainly for irrigated orchards, hay, pasture, some row crops (fig. 4), dryland crops, and woodland. It is subject to flooding during spring runoff in years of high snowfall. Capability unit IIIw–1 dryland; IIIw–1 irrigated; orchard group 7; woodland suitability 2o.

Cashmere Series

The Cashmere series consists of deep, well drained soils formed in mixed outwash material and alluvium. These nearly level to very steep soils are on low-lying terraces and their escarpments and on alluvial fans at elevations of 700 to 1,500 feet. The native vegetation is mainly bluebunch wheatgrass, needleandthread, and big sagebrush. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature is about 49° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown fine sandy loam about 8 inches thick. The subsoil is brown fine sandy loam about 17 inches thick. The substratum is pale brown fine sandy loam and loamy fine sand that extends to 60 inches or more.

Permeability is moderately rapid. The available water capacity is high. Roots penetrate to 60 inches or more.

Cashmere soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing.

Representative profile of Cashmere fine sandy loam, 8 to 15 percent slopes, in area of native range about 140 feet west of Watson Draw Road; 500 feet west and 140 feet north of southeast corner NW¼NW¼ sec. 36, T. 30 N., R. 23 E.

A11—0 to 2 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many fine roots; many very fine pores; neutral; abrupt smooth boundary.

A12—2 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak coarse granular structure; soft, very friable, nonsticky, nonplastic; many fine roots; many fine and very fine pores; neutral; clear smooth boundary.

B2—8 to 25 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak coarse prismatic structure; soft, very friable, nonsticky, nonplastic; many fine roots; few fine and very fine pores; neutral; gradual smooth boundary.

C1—25 to 44 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3)

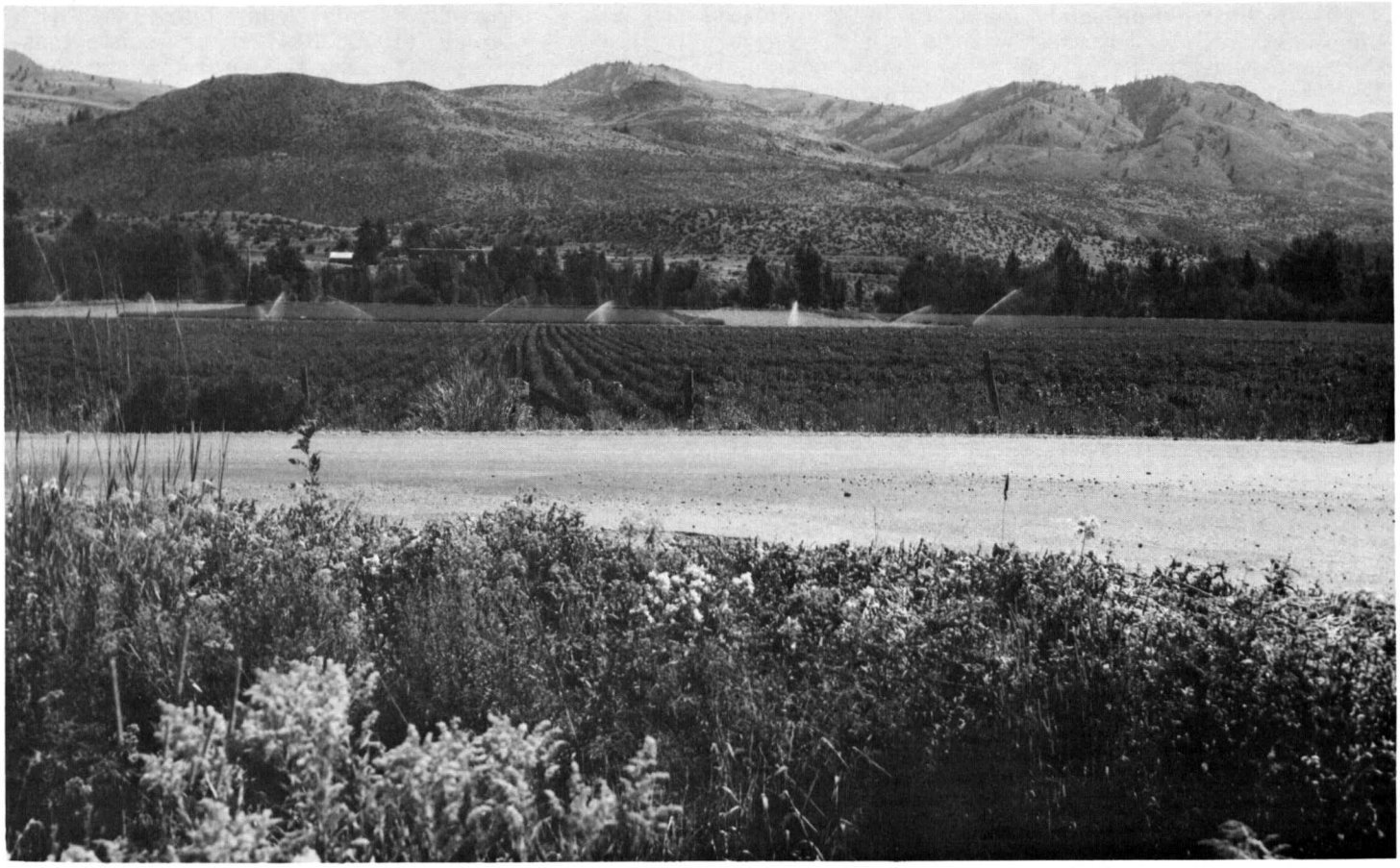

Figure 4.—**Potatoes on Boesel silt loam, heavy subsoil variant. Hills in background are part of the Newbon-Conconully association.**

when moist; massive; soft, very friable, nonsticky, nonplastic; common fine roots; few fine and medium tubular pores; neutral; gradual smooth boundary.

C2—44 to 65 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, nonplastic; few fine roots; few fine and very fine tubular pores; neutral.

Texture of the A horizon is either sandy loam or fine sandy loam. Texture of the B horizon ranges from coarse sandy loam to fine sandy loam. Texture of the C horizon ranges from fine sandy loam to coarse sandy loam above 40 inches and from fine sandy loam to loamy fine sand below 40 inches. Thin strata of sand, silt, or gravel can also occur. Calcium carbonate can occur in the lower part of the C horizon in the more stratified profiles.

7—Cashmere fine sandy loam, 0 to 3 percent slopes. As much as 10 percent of the total acreage of this soil is included areas of Aeneas fine sandy loam, Cashmont sandy loam, and Okanogan loam. Also included are small areas of soils moderately affected by salt and alkali.

Runoff is very slow, and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IIIe–2 dryland, IIe–1 irrigated; orchard group 1; range site 3.

8—Cashmere fine sandy loam, 3 to 8 percent slopes. As much as 10 percent of the total acreage of this soil is included areas of Aeneas fine sandy loam, Cashmont sandy loam, and Okanogan loam. Also included are small areas that are moderately salt and alkali affected.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 1; range site 3.

9—Cashmere fine sandy loam, 8 to 15 percent slopes. As much as 15 percent of the total acreage of this soil is included areas of Aeneas fine sandy loam, Cashmont sandy loam, and Tonasket silt loam.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IIIe–2 dryland, IVe–1 irrigated; orchard group 1; range site 3.

10—Cashmere fine sandy loam, 15 to 25 percent slopes. As much as 15 percent of the total acreage of soil is included areas of Cashmont sandy loam and Tonasket silt loam. Also included are a few small areas of soils moderately affected by saline and alkali salts.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IVe–3 dryland, VIe–1 irrigated; orchard group 1; range site 3.

11—Cashmere fine sandy loam, 25 to 65 percent slopes. Included with this soil in mapping were a few small areas of Tonasket silt loam.

Runoff is medium to very rapid, and the hazard of erosion is moderate to very high.

This soil is used mainly for grazing. Capability unit VIIe–1 dryland; range site 3.

Cashmont Series

The Cashmont series consists of deep, well drained soils formed in glacial outwash. These nearly level to steep soils are on till plains or terraces at elevations of 700 to 1,500 feet. The native vegetation is mainly bluebunch wheatgrass, needleandthread, and big sagebrush. The mean annual precipitation is 8 to 11 inches, the mean annual air temperature is about 49° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown sandy loam about 8 inches thick. The subsoil is brown gravelly sandy loam about 15 inches thick. The substratum is yellowish brown gravelly sandy loam that extends to 60 inches or more.

Permeability is moderately rapid. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Cashmont soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing.

Representative profile of Cashmont sandy loam, 3 to 8 percent slopes, in area of native range about 200 feet south and 970 feet west of center of sec. 31, T. 31 N., R. 23 E.

A11—0 to 3 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 5 percent gravel; neutral; abrupt smooth boundary.

A12—3 to 8 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak coarse granular structure; soft, very friable, nonsticky, nonplastic; common roots; few fine pores; 5 percent gravel; neutral; clear smooth boundary.

B2—8 to 23 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak coarse prismatic structure; soft, very friable, nonsticky, nonplastic; common roots; common very fine pores; 20 percent gravel; neutral; gradual smooth boundary.

C—23 to 60 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 3/4) when moist; massive; soft, very friable, nonsticky, nonplastic; common roots to 45 inches, few below; few very fine pores; 30 percent gravel and cobbles; neutral.

Texture of the A horizon is fine sandy loam, sandy loam, gravelly sandy loam, very gravelly sandy loam, or extremely stony sandy loam. The coarse fragment content of the B and C horizons is dominantly gravel and ranges from 20 to 35 percent. The texture of the B horizon is either gravelly coarse sandy loam or gravelly fine sandy loam. The texture of the C horizon ranges from gravelly fine sandy loam to gravelly coarse sandy loam above a depth of 40 inches but ranges to gravelly loamy sand below 40 inches.

12—Cashmont sandy loam, 0 to 3 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Pogue fine sandy loam, Nighthawk loam, and Conconully loam. Also included are small salt and alkali-affected areas.

Runoff is very slow, and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IVe–3 dryland, IIe–1 irrigated; orchard group 1; range site 3.

13—Cashmont sandy loam, 3 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Pogue fine sandy loam, Nighthawk loam, and Conconully loam. Also included are small areas where the surface layer is moderately affected by saline and alkali salts.

Runoff is slow, and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IVe–3 dryland, IIIe–1 irrigated; orchard group 1; range site 3.

14—Cashmont sandy loam, 8 to 15 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Pogue fine sandy loam, Nighthawk loam, and Conconully loam. Also included are small areas where the surface layer is moderately affected by saline and alkali salts.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing. Capability unit IVe–3 dryland, IVe–1 irrigated, orchard group 1; range site 3.

15—Cashmont sandy loam, 15 to 25 percent slopes. As much as 5 percent of the total acreage of this mapping unit is included areas of Cashmont very gravelly sandy loam, 3 percent Pogue fine sandy loam, and 2 percent Cashmere fine sandy loam. Also included are small areas where the soil is calcareous below 40 inches.

Runoff is medium, and the hazards of erosion and soil blowing are moderate.

This soil is used mainly for irrigated orchards, hay,

pasture, and grazing. Capability unit IVe–3 dryland, VIe–1 irrigated; orchard group 1; range site 3.

16—Cashmont gravelly sandy loam, 0 to 8 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly sandy loam. As much as 15 percent of the total acreage is included areas of Cashmere fine sandy loam, Pogue gravelly fine sandy loam, and Conconully loam. Also included are a few small areas of Cashmont sandy loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay and pasture, and grazing. Capability unit VIe–2 dryland, IIIe–1 irrigated; orchard group 1; range site 3.

17—Cashmont gravelly sandy loam, 8 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is a gravelly sandy loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Pogue gravelly fine sandy loam, and Conconully loam. Also included are a few small areas of Cashmont sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, and grazing. Capability unit VIe–2 dryland, IVe–1 irrigated; orchard group 1; range site 3.

18—Cashmont very gravelly sandy loam, 3 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is about 4 inches thick and a very gravelly sandy loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Pogue gravelly fine sandy loam and Cashmont gravelly sandy loam. Also included are a few small areas where slopes are greater than 25 percent and a few small areas where the soil is calcareous below a depth of 40 inches.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for grazing. Capability unit VIe–2 dryland; range site 3.

19—Cashmont extremely stony sandy loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 5 percent of the total acreage of this mapping unit is included areas of Nighthawk extremely stony loam, 3 percent Cashmont sandy loam, and 3 percent Conconully extremely stony loam. Also included are a few small areas of a soil that is calcareous below a depth of 40 inches.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for grazing. A few areas are irrigated and used for orchard, alfalfa hay, and pasture after some of the stones have been removed. Capability unit VIs–3 dryland, VIs–1 irrigated; orchard group 6; range site 3.

20—Cashmont extremely stony sandy loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Nighthawk extremely stony loam, Conconully extremely stony loam, and Rock outcrop. Also included are a few small areas of a soil that is calcareous below a depth of 40 inches.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for grazing. Capability unit VIIs–1 dryland; range site 3.

Chesaw Series

The Chesaw series consists of deep, somewhat excessively drained soils underlain by very gravelly sand. These moderately steep to steep soils are on terraces and eskers at elevations of 2,800 to 3,500 feet. They formed in glacial outwash. The vegetation is mainly bluebunch wheatgrass, Idaho fescue, and snowberry. The mean annual precipitation is 14 to 17 inches, the mean annual air temperature is about 43° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark gray extremely stony sandy loam about 5 inches thick. The next layer is dark grayish brown very gravelly loamy sand about 12 inches thick. The underlying material is grayish brown very gravelly sand that extends to 60 inches or more.

Permeability is very rapid. The available water capacity is low. Roots penetrate to 60 inches or more.

Chesaw soils are used mainly for grazing.

Representative profile of Chesaw extremely stony sandy loam, 15 to 45 percent slopes, in area of native range about 160 feet south and 100 feet east of northwest corner SE¼ sec. 30, T. 40 N., R. 30 E.

A1—0 to 5 inches; dark gray (10YR 4/1) extremely stony sandy loam, black (10YR 2/1) when moist; weak medium granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 40 percent cobbles, gravel, and stones; neutral; clear smooth boundary.

AC—5 to 17 inches; dark grayish brown (10YR 4/2) very gravelly loamy sand, very dark brown (10YR 2/2) when moist; massive, loose, very friable, nonsticky, nonplastic; common roots; porous; 45 percent gravel and cobbles; neutral; clear smooth boundary.

C—17 to 60 inches; grayish brown (10YR 5/2) very gravelly sand; very dark grayish brown (10YR 3/2) when moist; single grain, loose when dry and moist; common roots to 25 inches, few roots below; 50 percent gravel and cobbles; very porous; some pebbles have a coating of lime on lower sides; mildly alkaline.

The content of coarse fragments in the profile ranges from 35 to 70 percent. The fragments are mainly pebbles, but in some places they are as much as 40 percent cobbles and stones. Texture of the A1 horizon ranges from gravelly sandy loam to extremely stony sandy loam. Texture of the C horizon ranges from very gravelly sand and gravelly sand to very gravelly loamy sand.

21—Chesaw gravelly sandy loam, 15 to 45 percent slopes. This soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly sandy loam. As much as 15 percent of

the total acreage of this mapping unit is included areas of Republic gravelly sandy loam, Republic extremely stony sandy loam, Mires gravelly loam, Mires gravelly sandy loam, Mires extremely stony sandy loam, and Chesaw extremely stony sandy loam.

Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is used mainly for grazing. Capability unit VIe–2 dryland; range site 7.

22—Chesaw extremely stony sandy loam, 15 to 45 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Republic gravelly sandy loam, Republic extremely stony sandy loam, Mires gravelly loam, Mires gravelly sandy loam, Mires extremely stony sandy loam, and Chesaw gravelly sandy loam.

Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is used mainly for grazing. Capability unit VIIs–1 dryland; range site 7.

Colville Series

The Colville series consists of deep, somewhat poorly drained soils formed in mixed alluvium derived principally from acid igneous rocks and volcanic ash. These nearly level soils occupy bottom lands, basins, and depressions along perennial streams at elevations of 900 to 2,000 feet. The native vegetation is mainly aspen, willow, basin wildrye, saltgrass, and sedges. The mean annual precipitation is 11 to 14 inches, the mean annual air temperature is about 45° F., and the frost-free season is 120 to 135 days.

In a representative profile the surface layer is dark gray silt loam and silty clay loam about 17 inches thick. The subsoil is a mottled gray and light gray silt loam and silty clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is mottled light gray and pale brown silty clay loam.

Permeability is moderately slow. The available water capacity is high. Roots penetrate to a depth of 60 inches or more. The seasonal high water table ranges from 0 to 5 feet.

Colville soils are used mainly for irrigated hay and pasture, dryland crops, and grazing. Some small areas are in woodland.

Representative profile of Colville silt loam, in cultivated field about 2,200 feet south and 1,600 feet east of northwest corner sec. 35, T. 40 N., R. 25 E.

Ap1—0 to 4 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; many very fine pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—4 to 9 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; few fine and many very fine pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A13—9 to 17 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; moderate medium prismatic structure; hard, firm, sticky, plastic; common roots; many fine and very fine pores; slightly effervescent; moderately alkaline; clear wavy boundary.

B1—17 to 21 inches; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few roots; many fine and few medium pores; violently effervescent; strongly alkaline; abrupt smooth boundary.

B2g—21 to 33 inches; light gray (10YR 7/1) silty clay loam, gray (5YR 5/1) when moist; few distinct dark brown (7.5YR 4/4) mottles; moderate fine and medium subangular blocky structure; hard, firm, sticky, plastic; few roots; common fine pores; violently effervescent; strongly alkaline; abrupt smooth boundary.

C1—33 to 43 inches; light gray (2.5Y 7/2) silty clay loam, olive gray (5Y 5/2) when moist; few distinct dark brown (7.5YR 4/4) mottles; massive; slightly hard, friable, sticky, plastic; few roots; many fine and common medium pores; violently effervescent; strongly alkaline; abrupt smooth boundary.

C2—43 to 60 inches; pale brown (10YR 6/3) silty clay loam, dark brown or brown (10YR 4/3) when moist; common faint dark yellowish brown (10YR 4/4) mottles, massive; slightly hard, friable, sticky, plastic; very few roots; many fine and few medium pores; violently effervescent; strongly alkaline.

Reaction ranges from moderately alkaline to strongly alkaline throughout the profile. Texture of the A horizon ranges from silt loam to silty clay loam. The texture of the B2g horizon ranges from silty clay loam to clay loam. The C horizon is silt loam and silty clay loam. In places the C horizon contains 4-inch lenses of fine sandy loam, fine sand, and pumice.

23—Colville silt loam. This soil has the profile described as representative of the series. As much as 5 percent of the total acreage is included areas of Boesel fine sandy loam, moderately wet, and 5 percent is Xerofluvents, wet. Also included are a few small areas where the surface layer is noncalcareous and small areas where the texture throughout the profile is silt loam.

Runoff is very slow, and the hazard of erosion is none or slight. The soil is subject to flooding during spring runoff in years of high snowfall. The seasonal high water table is at or near the surface in spring.

This soil is used mainly for irrigated hay and pasture. Some areas are used for dryland crops and woodland. Capability unit IVw–1 dryland, IVw–1 irrigated; woodland suitability 2w.

24—Colville silt loam, moderately wet. As much as 5 percent of the total acreage of this mapping unit is included areas of Boesel fine sandy loam, 5 percent Okanogan loam, 5 percent Colville silt loam, and 5 per-

cent Xerofluvents, wet. Also included are a few small areas where the surface layer is noncalcareous.

Runoff is very slow, and the hazard of erosion is none or slight. Flooding is a hazard during spring runoff in years of high snowfall. The seasonal high water table is 2 to 5 feet below the surface.

This soil is used mainly for irrigated hay, pasture, dryland crops, and grazing. Capability unit IIIw–1 dryland, IIIw–1 irrigated; range site 2.

Conconully Series

The Conconully series consists of deep, well drained soils formed in glacial till. These nearly level to very steep soils are on uplands at elevations of 1,500 to 3,000 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and scattered ponderosa pine. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is about 49° F., and the frost-free season is 130 to 150 days.

In a representative profile the surface layer is dark grayish brown extremely stony loam 13 inches thick. The subsoil is brown and pale brown gravelly fine sandy loam and gravelly sandy loam about 20 inches thick over a light brownish gray gravelly sandy loam substratum that extends to 60 inches or more.

Permeability is moderate or moderately rapid to a depth of about 13 inches and moderately rapid below. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Conconully soils are used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops, grazing, and woodland.

Representative profile of Conconully extremely stony loam, 0 to 25 percent slopes, in area of native range about 340 feet east and 300 feet south of northwest corner SW¼SW¼ sec. 23, T. 31 N., R. 22 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) when moist; weak thick platy structure parting to weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 35 percent cobblestones, gravel, and stones; neutral; abrupt smooth boundary.

A12—2 to 13 inches; dark grayish brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) when moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 30 percent cobblestones, gravel, and stones; neutral; clear smooth boundary.

B21—13 to 21 inches; brown (10YR 5/3) gravelly fine sandy loam, dark brown (10YR 3/3) when moist; weak medium prismatic structure; soft, very friable, nonsticky, nonplastic; common roots; few fine pores; 20 percent gravel and cobblestones; neutral; clear smooth boundary.

B22—21 to 33 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 4/3) when moist; weak medium prismatic structure; slightly hard, very friable, nonsticky, nonplastic; common roots; few fine pores; 20 percent gravel and cobblestones; neutral; clear smooth boundary.

C—33 to 60 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; soft, very friable, nonsticky, nonplastic; 40 percent gravel and cobblestones; neutral.

Texture of the A horizon ranges from coarse sandy loam to loam that is gravelly or stony in places. Gravel content ranges from about 5 to 20 percent. The texture of the B horizon ranges from gravelly coarse sandy loam to gravelly fine sandy loam. The C horizon is gravelly coarse sandy loam or gravelly sandy loam.

25—Conconully gravelly sandy loam, 3 to 8 percent slopes. This soil has a profile similar to the one described as representative of the series, but it is not stony and the surface layer is gravelly sandy loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully loam, Disautel loam, and Conconully extremely stony loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops, grazing, and woodland. Capability unit IVe–3 dryland, IVe–1 irrigated; orchard group 4; range site 5; woodland suitability 5o.

26—Conconully gravelly sandy loam, 8 to 25 percent slopes. This soil has a profile similar to the one described as representative of the series, but it is not stony and the surface layer is gravelly sandy loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully loam, Disautel loam, and Conconully extremely stony loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops, grazing, and woodland. Capability unit IVe–3 dryland, IVe–1 irrigated; orchard group 4; range site 5; woodland suitability 5o.

27—Conconully loam, 0 to 8 percent slopes. This soil has a profile similar to the one described as representative of the series, but it is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Haley fine sandy loam, Newbon loam, Disautel loam, and Cashmont sandy loam.

Runoff is slow, and the hazard of erosion slight.

This soil is used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops, grazing, and woodland. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 4; range site 5; woodland suitability 5o.

28—Conconully loam, 8 to 15 percent slopes. This soil has a profile similar to the one described as representative of the series, but it is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Haley fine sandy loam, Newbon loam, Disautel loam, and Cashmont sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops,

woodland, and grazing. Capability unit IIIe–2 dryland, IVe–1 irrigated; orchard group 4; range site 5; woodland suitability 5o.

29—Conconully loam, 15 to 25 percent slopes. This soil has a profile similar to the one described as representative of the series, but it is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Haley fine sandy loam, Newbon loam, Disautel loam, and Cashmont sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for grazing and woodland. Some areas are used for dryland crops. Capability unit IVe–3 dryland; range site 5; woodland suitability 5o.

30—Conconully extremely stony loam, 0 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully loam, Conconully gravelly sandy loam, Newbon extremely stony loam, Disautel extremely stony loam, and Rock outcrop.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is used mainly for range. Capability unit VIs–3 dryland; range site 4.

31—Conconully extremely stony loam, 25 to 65 percent slopes. As much as 10 percent of the total acreage of this mapping unit is included areas of Disautel extremely stony loam and Newbon extremely stony loam. As much as 20 percent is an extremely stony loam that is similar to Conconully extremely stony loam but is 40 to 65 percent coarse fragments in the subsoil and substratum.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil is used mainly for grazing. Capability unit VIIs–1 dryland; range site 4.

32—Conconully extremely stony loam, 25 to 65 percent north slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Disautel extremely stony loam, Newbon extremely stony loam, Molson extremely stony silt loam, and Rock outcrop.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil is used mainly for grazing and woodland. Capability unit VIIs–1 dryland; range site 5; woodland suitability 5x.

Dinkelman Series

The Dinkelman series consists of deep, well drained soils formed in material weathered from granite, gneiss, and schist. These nearly level to very steep soils are on rough mountain slopes and narrow ridge crests at elevations of 2,000 to 3,500 feet. The vegetation is mainly Douglas-fir, ponderosa pine, pinegrass, and bluebunch wheatgrass. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is about 43° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish brown sandy loam about 14 inches thick. The subsoil is a pale brown fine sandy loam 14 inches thick. The substratum is pale brown gravelly fine sandy loam to a depth of 60 inches or more.

Permeability is moderately rapid. The available water capacity is moderately high or high. Roots penetrate to 60 inches or more.

Dinkelman soils are used mainly for woodland and grazed woodland. Small areas are used for irrigated orchards and dryland crops.

Representative profile of Dinkelman sandy loam, 0 to 25 percent slopes, in area of woodland SW¼NW¼ SE¼ sec. 15, T. 32 N., R. 24 E.

O1—½ inch to 0; partially decomposed needles, twigs, and dry grass.

A11—0 to 8 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak thin platy structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine and fine pores; 10 percent gravel; slightly acid; abrupt smooth boundary.

A12—8 to 14 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; common roots; many fine pores; 5 percent gravel; slightly acid; clear wavy boundary.

B2—14 to 28 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few roots; common fine pores; 5 percent gravel; neutral; clear wavy boundary.

C—28 to 60 inches; pale brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, nonplastic; few roots; common fine pores; 20 percent gravel; neutral.

Texture of the A horizon ranges from sandy loam to loam that is gravelly and extremely stony in places. Texture of the B horizon is sandy loam or fine sandy loam. Texture of the C horizon is gravelly sandy loam or gravelly fine sandy loam. Gravel content between depths of 10 to 40 inches ranges from 15 to 35 percent.

The Dinkelman soils in this survey area are deeper over bedrock than is defined as the range for the series. In mapping unit 38—Dinkelman loam, 25 to 48 percent slopes—the B horizon below a depth of 24 inches and the C horizon have slightly more clay and larger coarse fragments than is defined as the range for the series. These differences, however, do not significantly affect the use and management of the soils.

33—Dinkelman sandy loam, 0 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully loam, Donavan loam, Kartar sandy loam, Dinkelman gravelly sandy loam, and Leader fine sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. The hazard of soil blowing is moderate.

This soil is used mainly for woodland and grazed woodland. Small areas are used for dryland crops.

Capability unit IVe–2 dryland; woodland suitability 5o.

34—Dinkelman sandy loam, 25 to 65 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully loam, Donavan loam, Kartar sandy loam, Dinkelman gravelly sandy loam, and Leader fine sandy loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The hazard of soil blowing is moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit VIe–1 dryland; woodland suitability 5r.

35—Dinkelman gravelly sandy loam, 3 to 25 percent slopes. The profile of this soil is similar to the one described as representative of the series, but it has a gravelly sandy loam surface layer. As much as 15 percent of the total acreage of this mapping unit is included areas of Dinkelman sandy loam and Kartar sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for irrigated orchards, dryland crops, and woodland. Capability unit IVe–2 dryland, IVe–1 irrigated; orchard group 7; woodland suitability 5o.

36—Dinkelman extremely stony sandy loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described as representative of the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Donavan extremely stony loam, Kartar extremely stony sandy loam, and Merkel extremely stony sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight or moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit VIs–1 dryland; woodland suitability 5x.

37—Dinkelman extremely stony sandy loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described as representative of the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Donavan extremely stony loam, Kartar extremely stony sandy loam, and Merkel extremely stony sandy loam. Also included are a few small areas of Dinkelman very gravelly sandy loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for woodland and grazed woodland. Capability unit VIIs–1 dryland; woodland suitability 5x.

38—Dinkelman loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described as representative of the series, but the surface layer and upper part of the subsoil are loam and the lower subsoil and substratum are cobbly sandy clay loam. As much as 15 percent of the total acreage of this maping unit is included areas of Dinkelman sandy loam and Newbon loam. Also included are a few small areas where slopes are less than 25 percent and a few areas with a gravelly or extremely stony surface layer.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for woodland and grazed woodland. Capability unit VIe–1 dryland; woodland suitability 5r.

Disautel Series

The Disautel series consists of deep, well drained soils formed in glacial till. These nearly level to very steep soils are on uplands at elevations of 1,500 to 3,000 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, bitterbrush, and some scattered ponderosa pine. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is about 49° F., and the frost-free season is 130 to 150 days.

In a representative profile the surface layer is dark grayish brown and grayish brown silt loam about 16 inches thick. The subsoil is pale brown loam about 8 inches thick. The substratum is light gray gravelly loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Roots penetrate to 60 inches or more.

Disautel soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and range.

Representative profile of Disautel silt loam, 0 to 8 percent slopes, in area of native range about 175 feet south and 1,000 feet west of northeast corner sec. 25, T. 35 N., R. 28 E.

A11—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; 5 percent gravel; neutral; clear smooth boundary.

A12—9 to 16 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak coarse prismatic structure; soft, very friable, slightly sticky, slightly plastic; many roots; common very fine and few fine pores; 5 percent gravel; mildly alkaline; clear wavy boundary.

B2—16 to 24 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; common very fine pores; 10 percent gravel; mildly alkaline; clear wavy boundary.

C1ca—24 to 31 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) when moist; massive; hard, friable, slightly sticky, slightly plastic; few roots; few very fine pores; 20 percent gravel; common medium soft lime masses; moderately alkaline; abrupt smooth boundary.

C2ca—31 to 60 inches; light gray (2.5Y 7/2) gravelly loam, grayish brown (2.5Y 5/2) when moist; massive; hard, firm, slightly sticky, slightly plastic; few roots; few very fine pores; 30 percent gravel; strongly effervescent; strongly alkaline.

Texture of the A horizon ranges from very fine

sandy loam to silt loam and can be cobbly or extremely stony. The B horizon ranges from very fine sandy loam to silt loam. The content of coarse fragments ranges from 5 to 15 percent. Texture of the C horizon ranges from gravelly very fine sandy loam to gravelly silt loam. The content of coarse fragments ranges from 20 to 35 percent. Depth to the Cca horizon ranges from 22 to 32 inches.

39—Disautel silt loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Conconully loam, Nespelem silt loam, and Nighthawk loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 4; range site 5.

40—Disautel silt loam, 8 to 15 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Conconully loam, Nespelem silt loam, and Nighthawk loam. Also included are a few small gravelly areas where slopes are less than 8 percent.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range and dryland crops. Capability unit IIIe–2 dryland; range site 5.

41—Disautel silt loam, 15 to 25 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Conconully loam, Nespelem silt loam, and Nighthawk loam. Also included are a few areas where slopes are greater than 25 percent.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range and dryland crops. Capability unit IVe–3 dryland; range site 5.

42—Disautel very cobbly silt loam, 8 to 45 percent slopes, eroded. The profile of this soil is similar to the one described for the series, but the surface layer is about 10 inches thick and is 15 to 20 percent cobbles. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully extremely stony loam, Nighthawk extremely stony loam, and Rock outcrop.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range. Capability unit VIs–3 dryland; range site 4.

43—Disautel extremely stony silt loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully extremely stony loam, Nighthawk extremely stony loam, and Rock outcrop.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for range. Capability unit VIs–3 dryland; range site 4.

44—Disautel extremely stony silt loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully extremely stony loam, Nighthawk extremely stony loam, and Rock outcrop.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for grazing. Capability unit VIIs–1 dryland; range site 4.

Donavan Series

The Donavan series consists of deep, well drained soils formed in volcanic ash and the underlying glacial till. These nearly level to very steep soils are on uplands at elevations of 2,000 to 3,500 feet. The vegetation is mainly ponderosa pine, Douglas-fir, and pinegrass. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is about 43° F., and the frost-free season is 100 to 120 days.

In a representative profile a thin layer of organic litter overlies a grayish brown loam surface layer about 7 inches thick. The subsoil is pale brown silt loam 12 inches thick. The upper 20 inches of the substratum is light gray gravelly silt loam. The lower part is light gray gravelly sandy loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is moderately high or high. Roots penetrate to 60 inches or more.

Donavan soils are used mainly for woodland and grazed woodland. A small acreage is used for dryland crops and for hay and pasture.

Representative profile of Donavan loam, 8 to 25 percent slopes, in wooded area about 300 feet west and 175 feet north of southeast corner NE¼NE¼ sec. 34, T. 35 N., R. 28 E.

O1—1 inch to 0; needles and twigs.

A11—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak thin platy structure; soft, very friable; slightly sticky, slightly plastic; many roots; many very fine pores; slightly acid; abrupt smooth boundary.

A12—2 to 7 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; coarse granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many fine and very fine pores; slightly acid; clear smooth boundary.

B2—7 to 19 inches; pale brown (10YR 6/3) silt loam, dark brown or brown (10YR 4/3) when moist; weak medium prismatic structure; soft, very friable, slightly sticky, slightly plastic; many roots, many very fine and fine pores; slightly acid; clear smooth boundary.

IIC1—19 to 39 inches; light gray (10YR 7/2) gravelly silt loam, grayish brown (10YR 5/2) when moist; massive; hard, friable, slightly sticky, slightly plastic; few roots; many fine and very fine pores; 25 percent gravel; neutral; clear smooth boundary.

IIC2—39 to 60 inches; light gray (2.5Y 7/2) gravelly sandy loam, grayish brown

(2.5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky, nonplastic; few roots; many fine and very fine pores; 25 percent gravel; neutral.

Texture of the A and B horizons ranges from loam to silt loam. The A horizon is extremely stony in places. Texture of the C horizon ranges from gravelly sandy loam to gravelly silt loam. Gravel content of the C horizon ranges from 20 to 35 percent.

45—Donavan loam, 3 to 8 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Dinkelman sandy loam, Leader fine sandy loam, and Conconully loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for woodland and grazed woodland. Capability unit IIIe–1 dryland; woodland suitability 4o.

46—Donavan loam, 8 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Dinkelman sandy loam, Leader fine sandy loam, Nevine silt loam, and Conconully loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for woodland and grazed woodland. A small acreage is used for dryland crops and for hay and pasture. Capability unit IVe–2 dryland; woodland suitability 4o.

47—Donavan loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is about 3 inches thinner. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Dinkelman sandy loam, Leader fine sandy loam, Nevine silt loam, and Conconully loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for woodland and grazed woodland. Capability unit VIe–1 dryland; woodland suitability 4r.

48—Donavan extremely stony loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson extremely stony silt loam, Dinkelman extremely stony sandy loam, Nevine extremely stony silt loam, and Conconully extremely stony loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit VIs–1 dryland; woodland suitability 4x.

49—Donavan extremely stony loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson extremely stony silt loam, Dinkelman extremely stony sandy loam, Nevine extremely stony silt loam, and Conconully extremely stony loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for woodland, grazed woodland, and wildlife habitat. Capability unit VIIs–1 dryland; woodland suitability 4x.

50—Donavan-Rock outcrop complex, 25 to 65 percent slopes. This mapping unit is 55 percent Donavan extremely stony loam and 20 percent Rock outcrop. As much as 10 percent of the total acreage of this mapping unit is included areas of Lithic Xerochrepts. Also included are small areas of Molson extremely stony silt loam, Kartar extremely stony sandy loam, and Nevine extremely stony silt loam. The Donavan soil has a profile similar to the one described for the series, but the surface layer is 3 to 15 percent stones.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This mapping unit is used mainly for woodland, grazed woodland, and wildlife habitat. Capability unit VIIs–1 dryland; Donavan soil in woodland suitability 4x.

Emdent Series

The Emdent series consists of deep, somewhat poorly drained soils formed in alluvial material having a high percentage of pumicite. These nearly level soils are on bottom lands adjacent to perennial and some intermittent streams at elevations of 2,000 to 3,000 feet. The vegetation is mainly Canada bluegrass, sedges, rushes, and deciduous trees. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is about 45° F., and the frost-free season is 120 to 135 days.

In a representative profile the surface layer is dark gray loam and very fine sandy loam about 19 inches thick. The substratum is white very fine sandy loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Roots penetrate to a depth of 60 inches or more. The seasonal high water table is at a depth of 2.5 to 3.5 feet.

Emdent soils are used mainly for hay and pasture or woodland.

Representative profile of Emdent loam 825 feet east and 500 feet south from northwest corner NE¼NW¼ sec. 3, T. 36 N., R. 29 E.

A11—0 to 4 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) when moist; moderate fine granular structure; soft, friable, slightly sticky, slightly plastic; many roots; many very fine pores; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12—4 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) when moist; strong medium granular structure; soft, friable, slightly sticky, slightly plastic; common roots; many very fine pores; strong effervescence; moderately alkaline; abrupt smooth boundary.

A13—8 to 19 inches; dark gray (10YR 4/1) very fine sandy loam, black (10YR 2/1) when moist; weak thick platy structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; many

fine and few medium pores; moderately alkaline; abrupt smooth boundary.

C1—19 to 38 inches; white (2.5Y 8/2) very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; soft, very friable, nonsticky, nonplastic; few roots; common fine and few medium pores; moderately alkaline; clear smooth boundary.

C2—38 to 60 inches; white (N 8/0) very fine sandy loam, light gray or gray (N 6/0) when moist; many medium distinct greenish gray (5BG 5/1) mottles; massive; soft, very friable, nonsticky, nonplastic; few roots; few fine and medium pores; moderately alkaline.

Texture of the A horizon is loam or silt loam. The A horizon commonly has 1- to 3-inch lenses of white very fine sandy loam. The C horizon is commonly stratified with 1- to 3-inch lenses of fine gravel and coarse to fine sand.

The Emdent soils in this survey area are mostly at higher elevations than is defined as the range for the series. The higher elevation, however, does not significantly affect use and management of the soils.

51—Emdent loam. This nearly level soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Colville silt loam, Leavenworth silt loam, and Synarep silt loam.

Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 30 to 42 inches. This soil is subject to flooding during spring runoff in years of high snowfall.

This soil is used mainly for hay, pasture, and woodland. Capability unit VIw–1 dryland; woodland suitability 2w.

Ewall Series

The Ewall series consists of deep, excessively drained soils formed in glacial outwash sand. These nearly level to steep soils have ridged hummocky, dunelike relief. They are on terraces. Elevations range from 700 to 1,500 feet. The vegetation is mainly needleandthread, bluebunch wheatgrass, and big sagebrush. The mean annual precipitation is 12 to 15 inches, the mean annual air temperature is 49° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown and brown loamy fine sand about 15 inches thick. The underlying material is yellowish brown and pale brown sand that extends to 60 inches or more.

Permeability is dominantly rapid to a depth of about 15 inches and very rapid below. The available water capacity is low to moderate. Roots penetrate to 60 inches or more.

Ewall soils are used mainly for irrigated orchards, hay, pasture, and range.

Representative profile of Ewall loamy fine sand, 0 to 15 percent slopes, in area of native range about 750 feet north and 800 feet west of southeast corner SE¼NE¼ sec. 3, T. 32 N., R. 25 E.

A11—0 to 2 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak thick platy structure; soft, very friable; many roots; many very fine pores; discontinuous lenses of pumicite ¼ to ½ inch thick; neutral; abrupt smooth boundary.

A12—2 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak coarse granular structure; soft, very friable; many roots; many very fine pores; neutral; clear smooth boundary.

AC—7 to 15 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) when moist; massive; soft, very friable; many roots; many very fine pores; neutral; clear smooth boundary.

C1—15 to 26 inches; yellowish brown (10YR 5/4) sand, dark yellowish brown (10YR 3/4) when moist; single grained; loose when dry and moist; few roots; porous; neutral; clear smooth boundary.

C2—26 to 60 inches; pale brown (10YR 6/3) sand, dark brown (10YR 4/3) when moist; single grained; loose when dry and moist; few roots; porous; neutral.

Texture of the A horizon ranges from loamy fine sand to sand. In some places the C horizon contains lenses of gravel less than 4 inches thick.

52—Ewall sand, 0 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is sand. As much as 10 percent of the total acreage of this mapping is included areas of Skaha loamy sand, Skaha gravelly loamy sand, and Ewall loamy fine sand.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

This soil is used mainly for range. Capability unit VIIe–1 dryland; range site 1.

53—Ewall loamy fine sand, 0 to 15 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Skaha loamy sand, Skaha gravelly loamy sand, Aeneas fine sandy loam, and Cashmere fine sandy loam. Also included are some areas of soils that are similar to Ewall soils but are underlain by calcareous sediments at or below a depth of 36 inches.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

This soil is used mainly for irrigated orchards, hay, pasture, and range. Capability unit VIe–2 dryland, IVe–1 irrigated; orchard group 3; range site 1.

54—Ewall loamy fine sand, 15 to 25 percent slopes. As much as 20 percent of this mapping unit is included areas of Skaha gravelly loamy sand, Aeneas fine sandy loam, and Cashmere fine sandy loam. In some places this Ewall soil has calcareous sediments at or below a depth of 36 inches.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

This soil is used mainly for irrigated orchards and range. Capability unit VIe–2 dryland; VIe–1 irrigated; orchard group 3; range site 1.

55—Ewall loamy fine sand, 25 to 45 percent slopes. As much as 20 percent of the total acreage of this

mapping unit is included areas of Skaha gravelly loamy sand.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. The hazard of soil blowing is high.

This soil is used mainly for grazing. Capability unit VIe–2 dryland; range site 1.

Haley Series

The Haley series consists of deep, well drained soils underlain by sand. These nearly level to steep soils are on terraces and terrace escarpments at elevations of 1,400 to 3,000 feet. They formed in glacial outwash. The vegetation is mainly bluebunch wheatgrass, Idaho fescue, and big sagebrush. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is about 49° F., and the frost-free season is 130 to 150 days.

In a representative profile the surface layer is dark grayish brown and grayish brown fine sandy loam about 12 inches thick. The subsoil is pale brown fine sandy loam about 13 inches thick. The substratum is light brownish gray sand to 60 inches or more.

Permeability is moderately rapid to about 25 inches, and rapid below. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Haley soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and grazing.

Representative profile of Haley fine sandy loam, 0 to 8 percent slopes, in cultivated area about 1,000 feet south and 300 feet east of northwest corner sec. 32, T. 37 N., R. 28 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; neutral; clear smooth boundary.

A12—8 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak coarse granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine and fine pores; neutral; clear smooth boundary.

B2—12 to 25 inches; pale brown (10YR 6/3) fine sandy loam, dark yellowish brown (10 YR 3/4) when moist; weak medium prismatic structure; soft, very friable, nonsticky, nonplastic; common roots; common fine pores; neutral; clear smooth boundary.

IIC1—25 to 60 inches; light brownish gray (10 YR 6/2) sand, dark grayish brown (10YR 4/2) when moist; single grained; loose when dry and moist; few roots; porous; neutral.

Depth to sand ranges from 20 to 30 inches. Gravel content throughout the profile is less than 10 percent. Texture of the A horizon is sandy loam or fine sandy loam. Texture of the B horizon ranges from coarse sandy loam to fine sandy loam.

56—Haley fine sandy loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Conconully loam, Owhi fine sandy loam, and Ewall loamy fine sand. Also included are several areas where sand is below a depth of 40 inches and a few small areas of a soil that is similar to the Haley soil but has a very dark gray surface layer.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IVe–3 dryland, IIIe–1 irrigated; orchard group 5; range site 5.

57—Haley fine sandy loam, 8 to 25 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Conconully loam, Owhi fine sandy loam, and Ewall loamy fine sand. Also included are several areas of a soil that is similar to Haley fine sandy loam but has sand below a depth of 40 inches.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for dryland crops, irrigated orchards, and range. Capability unit IVe–3 dryland, IVe–1 irrigated; orchard group 5; range site 5.

58—Haley fine sandy loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described as representative of the series, but the surface layer is about 3 inches thinner on south-facing slopes and 3 inches thicker on north-facing slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Conconully loam, Owhi fine sandy loam, and Ewall loamy fine sand. Also included are several areas where sand is below a depth of 40 inches and a few small areas of a soil that is similar to the Haley soil but has a very dark gray surface layer.

Runoff is rapid, and the hazard of erosion is high. The hazard of soil blowing is moderate.

This soil is used mainly for range. Capability unit VIe–2 dryland; range site 5.

Havillah Series

The Havillah series consists of deep, well drained soils formed in a thin mantle of volcanic ash and the underlying glacial till. These nearly level to steep soils are on uplands at elevations of 3,000 to 4,500 feet. The vegetation is mainly Idaho fescue, bluebunch wheatgrass, ponderosa pine, and Douglas-fir. The mean annual precipitation is 14 to 18 inches, the mean annual air temperature is about 43° F., and the frost-free season is 95 to 130 days.

In a representative profile the surface layer is dark gray and dark grayish brown silt loam about 19 inches thick. The subsoil is grayish brown gravelly silt loam about 5 inches thick. The substratum is brown and pale olive gravelly silt loam and gravelly loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Roots penetrate to 60 inches or more.

Havillah soils are used mainly for woodland, grazing, and dryland crops.

Representative profile of Havillah silt loam, 0 to 8 percent slopes, in cultivated area 660 feet west and 920

feet south of northeast corner sec. 15, T. 39 N., R. 29 E.

Ap—0 to 12 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; 5 percent gravel; neutral; abrupt smooth boundary.

A12—12 to 19 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak medium prismatic structure; soft, very friable, slightly sticky, slightly plastic; common roots; many very fine pores; 15 percent gravel; neutral; clear wavy boundary.

IIB2—19 to 24 inches; grayish brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; many fine pores; 20 percent gravel; neutral; clear wavy boundary.

IIC1—24 to 27 inches; brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few roots; common fine pores; 25 percent gravel; slightly effervescent; moderately alkaline; abrupt wavy boundary.

IIC2ca—27 to 60 inches; pale olive (5Y 6/3) gravelly loam, olive (5Y 5/3) when moist; massive; hard, firm, sticky, plastic; few roots; common fine pores; 30 percent gravel; strongly effervescent; moderately alkaline.

Depth to the unconformable gravelly material is 18 to 28 inches. Reaction ranges from neutral to strongly alkaline. Texture of the A horizon is loam, silt loam, or extremely stony silt loam. Texture of the B horizon is silt loam, loam, or gravelly silt loam. The texture of the C horizon is gravelly loam or gravelly clay loam.

59—Havillah silt loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Koepke silt loam, and Hunters silt loam. Also included are a few small areas of a soil that is similar to Havillah silt loam but is calcareous throughout the profile and is strongly alkaline.

This soil is used mainly for dryland crops, grazing, and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

60—Havillah silt loam, 8 to 15 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Koepke silt loam, and Hunters silt loam. Also included are a few small gravelly areas and a few areas where slopes are less than 8 percent.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryland crops, grazing, and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

61—Havillah silt loam, 15 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Koepke silt loam, and Hunters silt loam. Also included are a few small gravelly areas.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for grazing, woodland, and dryland crops. Capability unit IVe–1 dryland; range site 8; woodland suitability 3o.

62—Havillah silt loam, 15 to 45 percent slopes, eroded. The profile of this soil is similar to the one described for the series, but the surface layer is about 12 inches thinner. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam and Hunters silt loam, eroded. Also included are a few eroded knobs of exposed calcareous till and a few areas of Havillah silt loam where slopes are less than 15 percent.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for range. Capability unit VIe–2 dryland; range site 8.

63—Havillah extremely stony silt loam, 15 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson extremely stony silt loam. Also included are a few small areas where slopes are less than 15 percent or more than 45 percent.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for grazing and woodland. Capability unit VIs–1 dryland; range site 8; woodland suitability 4x.

Hodgson Series

The Hodgson series consists of deep, moderately well drained soils formed in calcareous lake sediments. These gently sloping to strongly sloping soils are on terraces at elevations of 2,000 to 4,500 feet. The vegetation is mainly ponderosa pine, Douglas-fir, and pinegrass. The mean annual precipitation is 17 to 21 inches, the mean annual air temperature is about 45° F., and the frost-free season is 110 to 120 days.

In a representative profile the surface layer is grayish brown silt loam about 6 inches thick. It is covered with a thin layer of organic litter. The subsoil is pale brown heavy silt loam about 9 inches thick. The substratum is light gray heavy silt loam and light silty clay loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Roots penetrate to 60 inches or more.

Hodgson soils are used mainly for woodland and grazed woodland. Some areas are used for dryland crops.

Representative profile of Hodgson silt loam, in area of woodland about 660 feet west and 100 feet south of northeast corner sec. 34, T. 35 N., R. 28 E.

O1—1 inch to 0; partially decomposed needles and twigs.

A1—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many fine and very fine pores; slightly acid; clear smooth boundary.

B1—6 to 9 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; moderate coarse granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; common fine and very fine pores; slightly acid; clear smooth boundary.

B2t—9 to 15 inches; pale brown (10YR 6/3) heavy silt loam, brown or dark brown (10YR 4/3) when moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; common fine and very fine pores; thin patchy clay films; slightly acid; abrupt smooth boundary.

C1—15 to 25 inches; light gray (2.5Y 7/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, sticky, slightly plastic; common roots; many very fine and fine pores; mildly alkaline; abrupt smooth boundary.

C2ca—25 to 40 inches; light gray (5Y 7/2) light silty clay loam, grayish brown (2.5Y 5/2) when moist; finely laminated; very hard, firm, sticky, plastic; few roots; common fine and very fine pores; many distinct olive (5Y 5/6) mottles in root channels; slightly effervescent between laminations; strongly alkaline; gradual smooth boundary.

C3—40 to 60 inches; light gray (5Y 7/2) light silty clay loam, grayish brown (2.5Y 5/2) when moist; finely laminated; very hard, firm, sticky, plastic; few roots; few fine and very fine pores; common distinct olive (5Y 5/6) mottles in root channels, slightly effervescent between laminations; moderately alkaline.

Depth to the Cca horizon ranges from 19 to 31 inches. In some places the C horizon has lenses of fine sand 1 to 2 inches thick.

The Hodgson soils in this survey area contain less clay in the B2t horizon and are at higher elevations than is defined as the range for the series. Use and management, however, are not significantly affected.

64—Hodgson silt loam, 3 to 15 percent slopes. As much as 5 percent of the total acreage of this mapping unit is included areas of a soil that is similar to Hodgson silt loam but has a substratum of very firm silt loam. Also included are a few small areas where slopes are less than 3 percent.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland and grazed woodland (fig. 5). Some areas are used for dryland crops. Capability unit IIIe–1 dryland; woodland suitability 3o.

Hum Series

The Hum series consists of deep, well drained soils formed in a thin mantle of volcanic ash and the underlying glacial till. These strongly sloping to moderately steep soils are on uplands at elevations of 3,000 to 5,000 feet. The vegetation is mainly bluebunch wheatgrass, Idaho fescue, and scattered ponderosa pine. The mean annual precipitation is 13 to 15 inches, the mean annual air temperature is 43° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is very dark grayish brown silt loam about 18 inches thick. The subsoil is yellowish brown gravelly silty clay loam about 24 inches thick. The substratum is pale brown gravelly silty clay loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Roots penetrate to 60 inches or more.

Hum soils are used mainly for dryland crops and range.

Representative profile of Hum silt loam, 8 to 20 percent slopes, in area of native range about 2,500 feet east and 600 feet north of southwest corner sec. 16, T. 40 N., R. 29 E.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; neutral; abrupt smooth boundary.

A12—5 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) when moist; weak medium prismatic structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; neutral; abrupt wavy boundary.

IIB2t—18 to 32 inches; yellowish brown (10YR 5/4) gravelly silty clay loam, dark yellowish brown (10YR 4/4) when moist; moderate medium angular blocky structure parting to moderate fine granular structure; slightly hard, friable, sticky, plastic; common roots; common fine pores; few thin discontinuous clay skins; 15 percent gravel; neutral; clear wavy boundary.

IIB22t—32 to 42 inches; yellowish brown (10YR 5/4) gravelly silty clay loam, dark yellowish brown (10YR 4/4) when moist; moderate medium angular blocky structure parting to moderate fine granular structure; slightly hard, firm, sticky, plastic; few roots; few fine pores; common thin discontinuous clay skins; 20 percent gravel; neutral; clear irregular boundary.

IIC—42 to 60 inches; pale brown (10YR 6/3) gravelly silty clay loam, dark yellowish brown (10YR 4/4) when moist; massive; very hard, firm, sticky, plastic; few

Figure 5.—**Hodgson silt loam formed in old lake sediments. This area was cleared and cultivated, but is now pastured and is slowly reverting to trees.**

roots; few fine pores; thin clay skins on pebbles; 20 percent gravel; neutral.

Texture of the A horizon is loam or silt loam. Texture of the B and C horizons is dominantly silty clay loam and clay loam, but there are thin strata of silty clay in places. Gravel content in the B and C horizons ranges from 15 to 20 percent.

65—Hum silt loam, 8 to 20 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam and Koepke silt loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryland crops and range. Capability unit IIIe–1 dryland; range site 8.

Hunters Series

The Hunters series consists of deep, well drained soils formed in glacial lake deposits. These nearly level to steep soils are on terraces at elevations of 3,000 to 4,500 feet. The vegetation is mainly Idaho fescue, bluebunch wheatgrass, and ponderosa pine. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is about 43° F., and the frost-free season is 95 to 120 days.

In a representative profile the surface layer is dark gray and gray silt loam about 15 inches thick. The subsoil is grayish brown silt loam about 9 inches thick. The substratum is light brownish gray and light gray silt loam to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Roots penetrate to 60 inches or more.

Hunter soils are used mainly for dryland crops, woodland, grazed woodland, and range.

Representative profile of Hunters silt loam, 0 to 8 percent slopes, in area of native range about 100 feet west and 40 feet north of northeast corner SE¼SW¼ sec. 2, T. 38 N., R. 28 E.

A11—0 to 3 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate medium platy structure; soft, very friable, slightly sticky, slightly plastic; many roots; many fine and very fine pores; neutral; abrupt smooth boundary.

A12—3 to 15 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist;

moderate coarse granular structure; soft, very friable, slightly sticky, slightly plastic; common roots; common fine and very fine pores; neutral; clear smooth boundary.

B2—15 to 24 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; common fine and very fine pores; neutral; clear smooth boundary.

C1—24 to 30 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, slightly sticky, slightly plastic; common roots; common fine and few medium pores; neutral; abrupt wavy boundary.

C2ca—30 to 60 inches; light gray (2.5Y 7/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; massive; hard, firm, sticky, plastic; few roots; common fine and few medium pores; strongly effervescent; slightly alkaline.

Texture of the A horizon ranges from very fine sandy loam to silt loam. Depth to the Cca horizon is 18 to 34 inches.

66—Hunters silt loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Havillah silt loam, and Republic loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for woodland, dryland crops, and grazed woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 2o.

67—Hunters silt loam, 8 to 15 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included area of Molson silt loam, Havillah silt loam, and Republic loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for woodland, dryland crops, and grazed woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 2o.

68—Hunters silt loam, 8 to 25 percent slopes, eroded. The profile of this soil is similar to the one described for the series, but the surface layer is about 6 inches thick. As much as 20 percent of the total acreage of this mapping unit is included areas of Havillah silt loam, eroded, Molson silt loam, and exposed knobs of calcareous sediments. Also included are a few small areas of noneroded soils, similar to Hunter silt loam, that have slopes of 15 to 25 percent.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryland crops and range. Capability unit IVe–1 dryland; range site 8; woodland suitability 2o.

69—Hunters silt loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is about 11 inches thick. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Havillah silt loam, and Republic loam.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range, woodland, and grazed woodland. Capability unit VIe–2 dryland; range site 8; woodland suitability 2r.

Karamin Series

The Karamin series consists of deep, well drained soils underlain by sand. These strongly sloping to moderately steep soils are on terraces at elevations of 3,000 to 4,500 feet. They formed in glacial outwash. The vegetation is mainly western larch, Douglas-fir, and lodgepole pine. The mean annual precipitation is 16 to 22 inches, the mean annual temperature is about 42° F., and the frost-free season is 100 to 110 days.

In a representative profile the surface layer, which is beneath a thin layer of organic litter, is gray sandy loam about 1 inch thick. The subsoil is pale brown and very pale brown sandy loam about 22 inches thick. The upper 18 inches of the substratum is light gray loamy fine sand. The lower part is multicolored sand that extends to 60 inches or more.

Permeability is moderately rapid to a depth of 23 inches and rapid below. The available water capacity is moderate or moderately high. Roots penetrate to 60 inches or more.

Karamin soils are used mainly for woodland and grazed woodland. Some areas are used for dryland crops.

Representative profile of Karamin sandy loam, 8 to 25 percent slopes, in area of woodland about 700 feet west and 550 feet south of northeast corner SE¼ sec. 36, T. 35 N., R. 28 E.

O1—1 inch to 0; needles and twigs, partially decomposed.

A2—0 to 1 inch; gray (10YR 6/1) sandy loam, very dark gray (10YR 3/1) when moist; massive; soft, very friable, nonsticky, nonplastic; many roots; many very fine and fine pores; slightly acid; abrupt wavy boundary.

B2—1 to 6 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) when moist; weak fine prismatic structure; soft, very friable, slightly sticky, nonplastic; many roots; many very fine and fine pores; slightly acid; clear smooth boundary.

B3—6 to 23 inches; very pale brown (10YR 7/3) fine sandy loam, brown or dark brown (10YR 4/3) when moist; weak medium prismatic structure; soft, very friable, slightly sticky, nonplastic; many roots; many fine and few medium pores; slightly acid; clear smooth boundary.

IIC1—23 to 41 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) when moist; massive; soft, very friable, nonsticky; nonplastic; common roots; common fine and few medium pores; neutral; clear smooth boundary.

IIC2—41 to 60 inches; multicolored sand; few roots; porous; neutral.

Depth to unconformable sandy material ranges from 18 to 25 inches. Texture of the A horizon is sandy loam or fine sandy loam. The C horizon is less than 10 percent coarse fragments.

70—Karamin sandy loam, 8 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 10 percent of the total acreage of this mapping unit is included areas of Merkel sandy loam, Hodgson silt loam, and Leader fine sandy loam. Also included are a few small areas where slopes are less than 8 percent or greater than 25 percent.

Runoff is medium. The hazards of erosion and soil blowing are moderate.

This soil is used mainly for woodland and grazed woodland. Some areas are used for dryland crops. Capability unit IVe–2 dryland; woodland suitability 4o.

Kartar Series

The Kartar series consists of deep, well drained soils underlain by very gravelly sand. These nearly level to very steep soils are on glacial plains at elevations of 2,000 to 3,500 feet. They formed in glacial till. The vegetation is mainly bluebunch wheatgrass, Idaho fescue, and ponderosa pine. The mean annual precipitation is 14 to 16 inches, the mean annual air temperature is about 49° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish gray extremely stony sandy loam 6 inches thick. The upper 10 inches of the subsoil is pale brown sandy loam, and the lower 12 inches is pale brown gravelly sandy loam. The substratum is very pale brown gravelly loamy sand and very gravelly sand that extends to 60 inches or more.

Permeability is moderately rapid to about 28 inches and very rapid below. The available water capacity is moderate. Roots penetrate to 60 inches or more.

Kartar soils are used mainly for woodland, grazed woodland, and range. Some areas are used for dryland crops and irrigated orchards, hay, and pasture.

Representative profile of Kartar extremely stony sandy loam, 0 to 25 percent slopes, in area of grassland 470 feet north and 560 feet east of southwest corner sec. 9, T. 31 N., R. 23 E.

A1—0 to 6 inches; light brownish gray (10YR 6/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine and medium granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 20 percent cobblestones, gravel and stones; neutral; clear wavy boundary.

B21—6 to 16 inches; pale brown (10YR 6/3) sandy loam, brown and dark brown (10YR 4/3) when moist; weak medium prismatic structure; soft, very friable, nonsticky, nonplastic; common roots; many fine pores; 20 percent cobblestones and gravel; neutral; clear wavy boundary.

B22—16 to 28 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) when moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; common roots; common fine pores; common fine faint dark yellowish brown (10YR 4/4) mottles; 20 percent gravel; neutral; clear wavy boundary.

IIC1—28 to 50 inches; very pale brown (10YR 7/3) gravelly loamy sand, brown (10YR 5/3) when moist; single grained; loose when dry and moist; few roots; porous; 35 percent gravel; neutral; gradual wavy boundary.

IIC2—50 to 60 inches; very gravelly sand.

Depth to the unconformable gravelly and sandy material is 24 to 38 inches. Content of coarse fragments in the A and B horizons ranges from 10 to 35 percent. Texture of the B horizon is sandy loam or fine sandy loam.

In mapping unit 73—Kartar sandy loam, 15 to 45 percent north slopes, the annual temperature is a few degrees cooler than is described as the range for the Kartar series. Use and management, however, are not significantly affected.

71—Kartar sandy loam, 3 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Merkel sandy loam, Conconully loam, Leader fine sandy loam, Dinkelman sandy loam, and Donavan loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, woodland, and range. Capability unit IVe–2 dryland, IVe–1 irrigated; orchard group 7; range site 5; woodland suitability 4o.

72—Kartar sandy loam, 15 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Merkel sandy loam, Conconully loam, Leader fine sandy loam, and Donavan loam.

Runoff is medium. The hazards of erosion and soil blowing are moderate.

This soil is used mainly for range, dryland crops, woodland, and grazed woodland. Capability unit IVe–2 dryland; range site 5; woodland suitability 4o.

73—Kartar sandy loam, 15 to 45 percent north slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 2 to 3 inches thicker and is not stony. As much as 15 percent of the total acreage of this mapping unit is included areas of Merkel sandy loam, Newbon gravelly loam, Dinkelman loam, and Nevine silt loam.

Runoff is medium to rapid, and the hazard of erosion is moderate to high. The hazard of soil blowing is moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit VIe–1 dryland; woodland suitability 4r.

74—Kartar extremely stony sandy loam, 0 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas

of Merkel extremely stony sandy loam, Conconully extremely stony loam, Dinkelman extremely stony sandy loam, and Donavan extremely stony loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for range, woodland, and grazed woodland. Capability unit VIs–1 dryland; range site 5; woodland suitability 4x.

75—Kartar extremely stony sandy loam, 25 to 65 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Merkel extremely stony sandy loam, Conconully extremely stony loam, Dinkelman extremely stony sandy loam, and Donavan extremely stony loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for range, woodland, and grazed woodland. Capability unit VIIs–1 dryland; range site 5; woodland suitability 4x.

Koepke Series

The Koepke series consists of deep, well drained soils formed in a mantle of volcanic ash and the underlying glacial till. These nearly level to steep soils are on uplands at elevations of 2,000 to 5,000 feet. The vegetation is mainly Idaho fescue, bluebunch wheatgrass, rough fescue, ponderosa pine, and Douglas-fir. The mean annual precipitation is 14 to 17 inches, the mean annual air temperature is about 43° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is very dark gray and very dark grayish brown silt loam about 35 inches thick. The underlying material is light gray gravelly loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Roots penetrate to 60 inches or more.

Koepke soils are used mainly for range, dryland crops, and woodland.

Representative profile of Koepke silt loam, 0 to 8 percent slopes, 2,025 feet south and 200 feet east of northwest corner sec. 21, T. 40 N., R. 29 E.

A11—0 to 7 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; neutral; gradual wavy boundary.

A12—7 to 18 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many fine and very fine pores; neutral; clear wavy boundary.

A13—18 to 35 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) when moist; weak medium prismatic structure parting to weak medium angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; many fine pores; neutral; abrupt wavy boundary.

IIC1ca—35 to 60 inches; light gray (2.5Y 7/2) gravelly loam, grayish brown (2.5Y 5/2) when moist; massive; very hard, firm, slightly sticky, slightly plastic; few very fine roots; common fine pores; 20 percent gravel; moderately alkaline; violent effervescence.

Texture of the A horizon ranges from very fine sandy loam to silt loam. Coarse fragments are less than 10 percent. Texture of the IIC horizon ranges from gravelly loam to gravelly silt loam. Coarse fragments range from 15 to 30 percent.

The Koepke soils in this survey area lack the IIB2 horizon that is defined in the range for the series. Use and management, however, are not significantly affected.

76—Koepke silt loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Havillah silt loam, Hunters silt loam, and Republic loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range, dryland crops, and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

77—Koepke silt loam, 8 to 15 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Havillah silt loam, Hunters silt loam, and Republic loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range, woodland, and dryland crops. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

78—Koepke silt loam, 15 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Havillah silt loam, Hunters silt loam, and Republic loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range, woodland, and dryland crops. Capability unit IVe–1 dryland; range site 8; woodland suitability 3o.

79—Koepke silt loam, 25 to 45 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Havillah silt loam, and Republic loam. Also included are a few areas where the surface layer is gravelly.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and woodland. Capability unit VIe–2 dryland; range site 8; woodland suitability 3r.

80—Koepke gravelly silt loam, 3 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly silt loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson silt loam, Koepke silt loam, Molson gravelly silt loam, Havillah silt loam, Republic loam, and Republic gravelly sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for dryland crops. Small areas are used for range and woodland. Capability unit IVe–1 dryland; range site 8; woodland suitability 3o.

Leader Series

The Leader series consists of deep, somewhat excessively drained soils underlain by fine sand. These nearly level to steep soils are on terraces and their escarpments at elevations of 2,000 to 3,500 feet. They formed in glacial outwash material. The vegetation is mainly ponderosa pine and Douglas-fir. The mean annual precipitation is 14 to 16 inches, the mean annual temperature is about 49° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer, beneath a thin layer of organic litter, is grayish brown fine sandy loam about 5 inches thick. The subsoil is pale brown and very pale brown fine sandy loam about 20 inches thick. The substratum is white loamy fine sand and fine sand that extends to 60 inches or more.

Permeability is moderately rapid to about 25 inches and rapid below. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Leader soils are used mainly for dryland crops, woodland, and irrigated orchards, hay, and pasture.

Representative profile of Leader fine sandy loam, 0 to 8 percent slopes, in area of woodland 350 feet south and 200 feet east of northwest corner SW¼SE¼ sec. 26, T. 35 N., R. 28 E.

O1—0 to 1 inch; partially decomposed needles and twigs.

A1—1 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine and medium granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; slightly acid; clear smooth boundary.

B21—5 to 13 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak medium prismatic structure; soft, very friable, nonsticky, nonplastic; many roots; many fine and very fine pores; slightly acid; clear smooth boundary.

B22—13 to 25 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 4/3) when moist; weak medium prismatic structure; soft, very friable, nonsticky, nonplastic; many roots; many fine and very fine pores; neutral; clear smooth boundary.

IIC1—25 to 39 inches; white (10YR 8/2) loamy fine sand, grayish brown (10YR 5/2) when moist; massive; soft, very friable, nonsticky, nonplastic; common roots; many very fine and fine pores; neutral; clear wavy boundary.

IIC2—39 to 60 inches; white (2.5Y 8/2) fine sand, light brownish gray (2.5Y 6/2) when moist; common fine faint brownish yellow mottles (10YR 6/6); single grained; loose when dry and moist; few roots; porous; neutral.

Depth to the unconformable sandy material is 20 to 27 inches. Content of coarse fragments in the profile ranges from 0 to 10 percent. Texture of the A horizon ranges from fine sandy loam to loam. Texture of the B horizon ranges from coarse sandy loam to fine sandy loam.

81—Leader fine sandy loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam, Haley fine sandy loam, and Ewall loamy fine sand.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for dryland crops, woodland, and irrigated orchards, hay, and pasture. Capability unit IVe–2 dryland, IIIe–1 irrigated; orchard group 7; woodland suitability 4o.

82—Leader fine sandy loam, 8 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam, Haley fine sandy loam, and Ewall loamy fine sand.

Runoff is medium. The hazards of erosion and soil blowing are moderate.

This soil is used mainly for woodland and dryland crops. Capability unit IVe–2 dryland; woodland suitability 4o.

83—Leader fine sandy loam, 25 to 45 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam, Haley fine sandy loam, and Karamin sandy loam.

Runoff is rapid, and the hazard of erosion is high. The hazard of soil blowing is moderate.

This soil is used mainly for woodland. Capability unit VIe–1 dryland; woodland suitability 4r.

Leavenworth Series

The Leavenworth series consists of deep, moderately well drained soils formed in alluvium. These nearly level soils are on bottomlands at elevations of 1,500 to 3,500 feet. The native vegetation is mainly aspen, willows, and grasses. The mean annual precipitation is 12 to 16 inches, the mean annual air temperature is about 44° F., and the frost-free season is 90 to 120 days.

In a representative profile the surface layer is dark gray silt loam about 21 inches thick. The underlying material is stratified, light gray and light yellowish brown very fine sandy loam, sandy loam, and coarse sand that extends to 60 inches or more.

Permeability is moderate to 21 inches and moderate to rapid in the stratified material below. The available water capacity is moderately high or high. Roots penetrate to 60 inches or more. The seasonal high water table is at a depth of 2 to 4 feet.

Leavenworth soils are used for dryland crops, mainly hay and pasture.

Representative profile of Leavenworth silt loam 50 feet south and 180 feet west of northeast corner SE¼ NE¼SE¼ sec. 4, T. 32 N., R. 24 E.

A11—0 to 3 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; many very fine pores; neutral; abrupt smooth boundary.

A12—3 to 21 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) when moist;

weak medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; many very fine and fine and common medium pores; neutral; diffuse wavy boundary.

C—21 to 60 inches; light gray (10YR 7/2) and light yellowish brown (10YR 6/4) stratified fine sandy loam, sandy loam, and coarse sand; massive; friable, slightly sticky, nonplastic; few roots; common fine and few medium pores; neutral.

Texture of the A horizon ranges from very fine sandy loam to silt loam. Texture of the C horizon is dominantly very fine sandy loam and sandy loam with 3- to 5-inch lenses of coarse sand. The C horizon has mottles in 5YR hue in some profiles. The seasonal high water table is at a depth of 2 to 4 feet.

The Leavenworth soils in this survey area have a silt loam A horizon. They also have a higher color value in the C horizon, occur at a higher elevation, are a few degrees cooler, and have less annual precipitation than is defined as the range for the series. Use and management, however, are not significantly affected.

84—Leavenworth silt loam. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Xerofluvents, wet, Emdent loam, Marsh, and Colville silt loam. Also included are a few areas of soils with gravelly underlying material and some areas that are somewhat poorly drained.

Runoff is very slow and the hazard of erosion is none or slight. Flooding is a hazard during spring runoff in years of high snowfall.

This soil is used mainly for dryland crops, mostly hay and pasture. Capability unit IIIw–1 dryland; woodland suitability 2w.

Lithic Xerochrepts

Lithic Xerochrepts are well drained soils that are shallow to very shallow over bedrock. They formed mainly in material weathered from acidic or basic igneous rock and sedimentary rock and partly in glacial till and a thin mantle of volcanic ash. These nearly level to very steep soils are on knolls, ridges, hilltops, and mountainsides at elevations of 700 to 5,000 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, eriogonum, and scattered ponderosa pine and Douglas-fir. The mean annual precipitation is 8 to 22 inches, the mean annual air temperature is 41 to 50° F., and the frost-free season is 90 to 180 days.

In most places the soil is a brown loam 5 to 20 inches thick over bedrock. Stones and cobbles are on the surface and throughout the soil.

Permeability is moderate. The available water capacity is low. Runoff is slow to very rapid, and the hazard of erosion is none to very severe. Roots penetrate as far down as bedrock.

Lithic Xerochrepts are used mainly for wildlife habitat, woodland, and grazing. Capability unit VIIs–1 dryland.

85—Lithic Xerochrepts-Cashmont complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Cashmont extremely stony sandy loam. As much as 15 percent of this unit is included areas of Rock outcrop and about 5 percent is Conconully extremely stony loam, Vallan gravelly silt loam, and Donavan extremely stony loam. The Cashmont soil has the profile described for the series, but the surface layer is 3 to 15 percent stones.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 4, Cashmont soil in range site 3.

86—Lithic Xerochrepts-Conconully complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Conconully, extremely stony loam. As much as 15 percent of this unit is included areas of Rock outcrop and about 5 percent is Cashmont extremely stony sandy loam, Vallan gravelly silt loam, and Donavan extremely stony loam. The Conconully soil has the profile described as representative of the series.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range. Capability unit VIIs–1 dryland; range site 4.

87—Lithic Xerochrepts-Donavan-Rock outcrop complex, 15 to 45 percent slopes. This mapping unit is 35 percent Lithic Xerochrepts, 30 percent Donavan extremely stony loam, and 25 percent Rock outcrop. As much as 10 percent of this unit is included areas of Conconully extremely stony loam, Vallan gravelly silt loam, and Molson extremely stony silt loam. The Donavan soil has the profile described as representative of the series, but the surface layer is 3 to 15 percent stones.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range, woodland, and wildlife habitat. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 4, Donavan soil in woodland suitability 4x.

88—Lithic Xerochrepts-Hum complex, 0 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Hum silt loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and 5 percent is Molson extremely stony silt loam, Vallan gravelly silt loam, and Republic extremely stony sandy loam. The Hum soil has the profile described as representative of the series.

Runoff is slow to rapid, and the hazard of erosion is slight to high.

This mapping unit is used mainly for range, woodland, and wildlife habitat. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 6, Hum soil in range site 8.

89—Lithic Xerochrepts-Kartar complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Kartar extremely stony sandy loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Conconully extremely stony loam, Donavan extremely stony loam, Nevine extremely stony silt loam, and Wadams extremely stony sandy

loam. The Kartar soil has the profile described as representative of the series.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range, woodland, and wildlife habitat. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 4, Kartar soil in range site 5; Kartar soil in woodland suitability 4x.

90—Lithic Xerochrepts-Molson complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Molson extremely stony silt loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Vallan gravelly silt loam, Hum silt loam, and Republic extremely stony sandy loam. The Molson soil has a profile similar to the one described for the series, but the surface layer is 3 to 15 percent stones.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range, woodland, and wildlife habitat. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 6, Molson soil in range site 8; Molson soil in woodland suitability 3x.

91—Lithic Xerochrepts-Nevine complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Nevine extremely stony silt loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Donavan extremely stony loam, Kartar extremely stony sandy loam, and Molson extremely stony silt loam. The Nevine soil has a profile similar to the one described for the series, but the surface layer is 3 to 15 percent stones.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for woodland and wildlife habitat. Capability unit VIIs–1 dryland; Nevine soil in woodland suitability 4x.

92—Lithic Xerochrepts-Newbon complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Newbon extremely stony loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Conconully extremely stony loam and Kartar extremely stony sandy loam. The Newbon soil has a profile similar to the one described for the series, but the surface layer is 3 to 15 percent stones.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 4, Newbon soil in range site 5.

93—Lithic Xerochrepts-Nighthawk complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Nighthawk extremely stony loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Vallan gravelly silt loam, Conconully extremely stony loam, and Cashmont extremely stony sandy loam. The Nighthawk soil has a profile similar to the one described for the series.

Runoff is medium to rapid, and the hazard of erosion is moderate to high. This mapping unit is used mainly for range. Capability unit VIIs–1 dryland; range site 4.

94—Lithic Xerochrepts-Republic complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Republic extremely stony sandy loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Vallan gravelly silt loam, Hum silt loam, and Molson extremely stony silt loam. The Republic soil has a profile similar to the one described for the series, but the surface layer is 3 to 15 percent stones.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range, woodland, and wildlife habitat. Capability unit VIIs–1 dryland; Lithic Xerochrepts in range site 6, Republic soil in range site 8; Republic soil in woodland suitability 4x.

95—Lithic Xerochrepts-Vallan complex, 15 to 45 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Vallan gravelly silt loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Molson extremely stony silt loam, Conconully extremely stony loam, Donavan extremely stony loam, and Hum silt loam. The Vallan soil has the profile described as representative of the series.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This mapping unit is used mainly for range, wildlife habitat, and woodland. Capability unit VIIs–1 dryland; range site 6; Vallan soil in woodland suitability 5d.

96—Lithic Xerochrepts-Wadams complex, 25 to 65 percent slopes. This mapping unit is 50 percent Lithic Xerochrepts and 30 percent Wadams extremely stony sandy loam. As much as 15 percent of the total acreage of this mapping unit is included areas of Rock outcrop and about 5 percent is Kartar extremely stony sandy loam. The Wadam soil has a profile similar to the one described for the series.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This mapping unit is used mainly for woodland and wildlife habitat. Capability unit VIIs–1 dryland; Wadams soil in woodland suitability 4x.

Marsh

97—Marsh is very poorly drained. The water table is generally at or above the surface layer, but the depth can range to 30 inches in summer. As much as 15 percent of the total acreage of this mapping unit is included areas of Emdent loam, Xerofluvents, wet, Leavenworth silt loam, and Colville silt loam.

This mapping unit is mainly in depressions and is impractical to drain. The vegetation consists mainly of rushes and cattails. Marsh is used for wildlife and water storage. Capability unit VIIIw–1 dryland.

Merkel Series

The Merkel series consists of deep, well drained soils formed in a mantle of volcanic ash and the underlying glacial till. These nearly level to very steep soils are on

uplands at elevations of 3,000 to 4,500 feet. The vegetation is mainly Douglas-fir, larch, ponderosa pine, and pinegrass. The mean annual precipitation is 16 to 22 inches, the mean annual air temperature is about 42° F., and the frost-free season is 90 to 110 days.

In a representative profile the surface layer is gray very fine sandy loam 1 inch thick. It is covered with a thin layer of organic litter. The subsoil is light yellowish brown gravelly sandy loam about 25 inches thick. The substratum is very pale brown very gravelly loamy sand that extends to 60 inches or more.

Permeability is moderately rapid to a depth of about 26 inches and very rapid below. The available water capacity is moderate. Roots penetrate to 60 inches or more.

Merkel soils are used mainly for woodland and grazed woodland.

Representative profile of Merkel sandy loam, 0 to 25 percent slopes, in area of woodland 250 feet east of Loop Loop Highway-Buzzard Lake Road SW¼NE¼ SE¼ sec. 32, T. 35 N., R. 25 E.

O1—1½ inches to 0; partially decomposing needles, twigs, and grass.

A1—0 to 1 inch; gray (10YR 5/1) very fine sandy loam, very dark gray (10YR 3/1) when moist; weak platy structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; slightly acid; abrupt wavy boundary.

B1—1 to 3 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; many fine pores; neutral; abrupt smooth boundary.

B2—3 to 26 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; common very fine pores; 40 percent gravel and cobbles; neutral; clear wavy boundary.

IIC—26 to 60 inches; very pale brown (10YR 7/3) very gravelly loamy sand, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky, nonplastic; common roots to 54 inches, few below; porous; 60 percent gravel and cobbles; neutral.

Texture of the A horizon ranges from sandy loam to loam that is extremely stony in places. Texture of the C horizon ranges from very gravelly sandy loam to very gravelly loamy sand.

98—Merkel sandy loam, 0 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Nevine silt loam, Kartar sandy loam, Dinkelman sandy loam, and Newbon gravelly loam. Also included are a few areas where slopes are greater than 25 percent.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit IVe–2 dryland; woodland suitability 4o.

99—Merkel extremely stony sandy loam, 3 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Nevine extremely stony silt loam, Kartar extremely stony sandy loam, and Dinkelman extremely stony sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit VIs–1 dryland; woodland suitability 4x.

100—Merkel extremely stony sandy loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Nevine extremely stony silt loam, Kartar extremely stony sandy loam, and Dinkelman extremely stony sandy loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for woodland. Capability unit VIIs–1 dryland; woodland suitability 4x.

Mires Series

The Mires series consists of deep, well drained soils underlain by very gravelly sand. These nearly level to very steep soils are on terraces and terrace escarpments at elevations of 3,000 to 4,500 feet. They formed in a mantle of volcanic ash and the underlying glacial outwash. The vegetation is mainly bluebunch wheatgrass, Idaho fescue, and scattered ponderosa pine. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is about 43° F., and the frost-free season is 95 to 120 days.

In a representative profile the surface layer is dark gray and dark grayish brown loam about 13 inches thick. The subsoil is brown gravelly sandy loam about 8 inches thick. The substratum is brown gravelly loamy sand and very gravelly sand that extends to 60 inches or more.

Permeability is dominantly moderate to 13 inches, and increases to very rapid below. The available water capacity is low to moderate. Roots penetrate to 60 inches or more.

Mires soils are used mainly for dryland crops, range, woodland, and grazed woodland.

Representative profile of Mires loam, 0 to 8 percent slopes, in cultivated field 660 feet east and 150 feet south of northwest corner sec. 36, T. 40 N., T. 29 E.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many roots; many very fine pores; neutral; abrupt smooth boundary.

A12—9 to 13 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) when moist; weak medium subangular blocky structure; soft, very friable, slightly

sticky, nonplastic; many roots; many very fine pores; neutral; abrupt wavy boundary.

IIB2—13 to 21 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 20 percent gravel; mildly alkaline; clear wavy boundary.

IIC1—21 to 29 inches; brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) when moist; single grain; loose when dry and moist; common roots; many very fine pores; 30 percent gravel; mildly alkaline; abrupt wavy boundary.

IIC2—29 to 60 inches; brown (10YR 5/3) very gravelly sand, dark brown (10YR 3/3) when moist; single grain; loose when dry and moist; few roots; very porous; 75 percent gravel; mildly alkaline.

Texture of the surface layer ranges from sandy loam to silt loam that can be gravelly or extremely stony. The content of coarse fragments ranges from 10 to 35 percent. The C horizon ranges from gravelly loamy sand to very gravelly sand.

101—Mires gravelly sandy loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly sandy loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Republic gravelly sandy loam, Owhi gravelly fine sandy loam, and Springdale sandy loam.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and woodland. Capability unit VIe–2 dryland; range site 7; woodland suitability 4r.

102—Mires extremely stony sandy loam, 15 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is sandy loam and is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Republic extremely stony sandy loam, Owhi extremely stony fine sandy loam, and Springdale extremely stony sandy loam.

Runoff is medium to very rapid, and the hazard of erosion is moderate to very high.

This soil is used mainly for range and woodland. Capability unit VIIs–1 dryland; range site 7; woodland suitability 4x.

103—Mires loam, 0 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Owhi fine sandy loam, Republic loam, Haley fine sandy loam, and Springdale sandy loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for dryland crops, range, and woodland. Capability unit IVe–1 dryland; range site 7; woodland suitability 4o.

104—Mires gravelly loam, 3 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Republic gravelly sandy loam, Owhi gravelly fine sandy loam, and Springdale sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for dryland crops, range, and woodland. Capability unit IVe–1 dryland; range site 7; woodland suitability 4o.

Molson Series

The Molson series consists of deep, well drained soils formed in a mantle of volcanic ash and the underlying glacial till. These nearly level to steep soils are on mountainous uplands at elevations of 1,900 to 4,500 feet. The vegetation is mainly Idaho fescue, bluebunch wheatgrass, ponderosa pine, and snowberry. The mean annual precipitation is 14 to 18 inches, the mean annual air temperature is 43° F., and the frost-free season is 95 to 130 days.

In a representative profile the surface layer is very dark grayish brown silt loam about 18 inches thick. The subsoil is yellowish brown gravelly silt loam and gravelly loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Roots penetrate to 60 inches or more. Molson soils are used mainly for dryland crops, range, and woodland.

Representative profile of Molson silt loam, 8 to 15 percent slopes, in cultivated area about 3/8 mile northeast of junction of Lemansky Lake and Pine Creek Road; 1,690 feet south and 1,350 feet west of northeast corner sec. 1, T. 36 N., R. 25 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) when moist; moderate medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; neutral; clear smooth boundary.

A12—8 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) when moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common roots; many very fine and fine pores; neutral; gradual smooth boundary.

IIB2—18 to 42 inches; yellowish brown (10YR 5/4) gravelly silt loam, dark yellowish brown (10YR 3/4) when moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky, slightly plastic; common roots; many fine pores; 30 percent gravel; neutral; clear smooth boundary.

IIC1—42 to 50 inches; light gray (2.5Y 7/2) gravelly silt loam, olive brown (2.5Y 4/4) when moist; massive; hard, firm, slightly sticky, slightly plastic; few roots; many fine pores; 30 percent gravel; slightly effervescent; mildly alkaline; diffuse wavy boundary.

IIC2—50 to 60 inches; light gray (5Y 7/2) weakly cemented gravelly loam, light olive brown (2.5 5/3) when moist; mas-

sive; very hard, very firm, slightly sticky, slightly plastic; few roots; few fine pores; 30 percent gravel; mildly alkaline.

Texture of the A horizon ranges from loam to silt loam that in places is gravelly or extremely stony. Texture of the B horizon ranges from silt loam to gravelly silt loam or gravelly loam.

105—Molson silt loam, 0 to 8 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Havillah silt loam, Koepke silt loam, Hum silt loam, and Republic loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for dryland crops, range, and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

106—Molson silt loam, 8 to 15 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Havillah silt loam, Koepke silt loam, Hum silt loam, and Republic loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryland crops, range and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

107—Molson silt loam, 15 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Havillah silt loam, Koepke silt loam, Hum silt loam, and Republic loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range, dryland crops, and woodland. Capability unit IVe–1 dryland; range site 8; woodland suitability 3o.

108—Molson silt loam, 25 to 45 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Havillah silt loam, Koepke silt loam, Hum silt loam, and Republic loam. Koepke silt loam is mainly on the north-facing slopes.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and woodland. Capability unit VIe–1 dryland; range site 8; woodland suitability 3r.

109—Molson gravelly silt loam, 3 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly silt loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Koepke gravelly silt loam, Republic gravelly sandy loam, Hum silt loam, and Molson silt loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for dryland crops, range, and woodland. Capability unit IVe–1 dryland; range site 8; woodland suitability 3o.

110—Molson extremely stony silt loam, 8 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 10 percent of the total acreage of this mapping unit is included area of Havillah extremely stony silt loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range and woodland. Capability unit VIs–3 dryland; range site 8; woodland suitability 3x.

111—Molson extremely stony silt loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 10 percent of the total acreage of this mapping unit is included areas of Havillah extremely stony silt loam.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and woodland. Capability unit VIIs–1 dryland; range site 8; woodland suitability 3x.

Nespelem Series

The Nespelem series consists of deep, well drained soils formed in calcareous lake sediments. These nearly level to steep soils are on dissected terraces at elevations of 1,500 to 3,000 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue. The mean annual precipitation is 11 to 14 inches, the mean annual air temperature is about 46° F., and the frost-free season is 120 to 135 days.

In a representative profile the surface layer is grayish brown silt loam about 11 inches thick. The subsoil is pale brown silt loam about 3 inches thick. The substratum to a depth of 60 inches or more is light gray silt loam.

Permeability is moderately slow or slow, and the available water capacity is high. Roots penetrate to a depth of 60 inches or more.

These soils are used mainly for dryland crops and rangeland.

Representative profile of Nespelem silt loam, 3 to 8 percent slopes, in area of native range 260 feet west and 300 feet north of southeast corner sec. 16, T. 35 N., R. 28 E.

A11—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; slightly acid; abrupt smooth boundary.

A12—2 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine pores; neutral; clear smooth boundary.

B2—11 to 14 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; many roots; many very fine or fine pores; neutral; clear smooth boundary.

C1—18 to 30 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, firm, slightly sticky, plastic; few roots; common fine and very fine pores; common medium to large faint dark grayish brown (10YR 4/2)

mottles; mildly alkaline; clear wavy boundary.

C2ca—30 to 36 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; very hard, slightly sticky, plastic; few roots; common fine and very fine pores; slightly effervescent; soft powdery lime in seams and pores; common medium to large distinct dark grayish brown (10YR 4/2) mottles; moderately alkaline; abrupt wavy boundary.

C3ca—36 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm, slightly sticky, plastic; few roots; common fine and very fine pores; strongly effervescent; common medium to large distinct dark grayish brown (10YR 4/2) mottles; moderately alkaline.

Depth to the Cca horizon ranges from 18 to 36 inches. Texture of the A horizon ranges from very fine sandy loam to silt loam. The C horizon is stratified with lenses of very fine sandy loam and silty clay loam less than 4 inches thick.

In mapping unit 117, the soil is not so well drained, the A horizon is lighter colored, and the B horizon contains more clay. Both the A and B horizons are more alkaline than is defined as the range for the series. These differences, however, do not significantly affect the use and management of this soil.

112—Nespelem silt loam, 3 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Disautel loam, Conconully loam, Haley fine sandy loam, and Ewall loamy fine sand.

Runoff is slow, permeability is moderately slow, and the hazard of erosion is slight. This soil is used mainly for dryland crops and range. Capability unit IIIe–2 dryland; range site 5.

113—Nespelem silt loam, 8 to 15 percent slopes. As much as 5 percent of the total acreage of this mapping unit is included areas of Disautel loam, Conconully loam, Haley fine sandy loam, and Ewall loamy fine sand.

Runoff is medium, permeability is moderately slow, and the hazard of erosion is moderate. This soil is used mainly for dryland crops and range. Capability unit IIIe–2 dryland; range site 5.

114—Nespelem silt loam, 15 to 25 percent slopes. This soil has a profile similar to the one described as representative of the series, but the surface layer is about 2 inches thinner. As much as 15 percent of the total acreage of this mapping unit is included areas of Disautel loam, Conconully loam, Haley fine sandy loam, and Ewall loamy fine sand.

Runoff is medium, permeability is moderately slow, and the hazard of erosion is moderate. This soil is used mainly for dryland crops and grazing. Capability unit IVe–3 dryland; range site 5.

115—Nespelem silt loam, 8 to 25 percent slopes, eroded. This soil has a profile similar to the one described as representative of the series, but the surface layer is 2 to 10 inches thinner. As much as 15 percent of the total acreage of this mapping unit is included areas of Nespelem silt loam, Disautel loam, and Disautel cobbly silt loam, eroded. Also included are a few small areas of eroded and exposed knobs of lacustrine sediments.

Runoff is medium, permeability is moderately slow, and the hazard of erosion is moderate. Much of the acreage was used for dryland crops but is now in permanent grass and is used for grazing. Capability unit IVe–3 dryland; range site 5.

116—Nespelem silt loam, 25 to 45 percent slopes. This soil has a profile similar to the one described as representative of the series, but the surface layer is about 4 inches thinner. As much as 15 percent of the total acreage of this mapping unit is included areas of Disautel loam, Conconully loam, and Hunters silt loam.

Runoff is rapid, permeability is moderately slow, and the hazard of erosion is high. This soil is used mainly for range. Capability unit VIe–2 dryland; range site 5.

117—Nespelem silt loam, alkali, 0 to 3 percent slopes. This soil has a profile similar to the one described as representative of the series, but the surface layer is lighter colored and strongly alkaline and the subsoil is silty clay loam. This soil is moderately well drained and strongly alkaline throughout. The vegetation is mainly salt-tolerant grass.

As much as 10 percent of the total acreage of this mapping unit is included areas of Nespelem silt loam and Disautel loam. Also included are a few areas where slopes are greater than 3 percent.

Runoff is very slow, permeability is slow, and the hazard of erosion is none to slight. The soil is used mainly for range. Capability unit VIs–2 dryland; range site 2.

Nevine Series

The Nevine series consists of deep, well drained soils formed in a mantle of volcanic ash and the underlying glacial till. These nearly level to very steep soils are on mountainous uplands at elevations of 3,000 to 4,500 feet. The vegetation is mainly Douglas-fir, larch, lodgepole pine, and pinegrass. The mean annual precipitation is 16 to 22 inches, the mean annual air temperature is about 42° F., and the frost-free season is 90 to 110 days.

In a representative profile the surface layer is gray silt loam 1 inch thick. It is covered with a thin layer of organic litter. The subsoil is about 48 inches thick. It is brown and yellowish brown silt loam in the upper 28 inches and light gray gravelly loam in the lower 20 inches. The substratum is light brownish gray gravelly sandy loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Roots penetrate to 60 inches or more.

Nevine soils are used mainly for woodland.

Representative profile of Nevine silt loam, 25 to 45 percent slopes, in area of woodland 400 feet south and 50 feet west of northeast corner NW¼NW¼ sec. 25, T. 35 N., R. 27 E.

O1—1 inch to 0; partially decomposed needles, twigs, and grass.

A2—0 to 1 inch; gray (10YR 6/1) silt loam, very

dark gray (10YR 3/1) when moist; weak medium granular structure; soft, very friable, slightly sticky, nonplastic, many roots; many fine pores; slightly acid; abrupt smooth boundary.

B21—1 to 11 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak coarse granular structure; soft, very friable, slightly sticky, slightly plastic; many roots; many fine pores; thin discontinuous pockets of pumicite; slightly acid; clear smooth boundary.

B22—11 to 29 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) when moist; moderate medium prismatic structure; slightly hard friable, slightly sticky, slightly plastic; many roots; many fine pores; clear wavy boundary.

B3—29 to 49 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) when moist; massive; hard, firm, slightly sticky, nonplastic; common roots; many fine and few medium pores; many medium distinct yellowish brown (10YR 4/4) mottles; 30 percent gravel; neutral; clear wavy boundary.

C—49 to 60 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; massive; very hard, very firm, slightly sticky, nonplastic; few roots; many fine and few medium pores; 30 percent gravel; mildly alkaline.

Texture of the A and B horizons is very fine sandy loam, silt loam, or extremely stony silt loam. The C horizon texture ranges from gravelly sandy loam to gravelly loam.

The Nevine soils in this survey area have a lower content of coarse fragments in the B and C horizons than is defined as the range for the series. This does not significantly affect the use and management of these soils.

118—Nevine silt loam, 8 to 25 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Merkel sandy loam, Hodgson silt loam, and Donavan loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for woodland. Capability unit IVe–2 dryland; woodland suitability 3o.

119—Nevine silt loam, 25 to 45 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Merkel sandy loam, Hodgson silt loam, and Donavan loam.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for woodland. Capability unit VIe–1 dryland; woodland suitability 3r.

120—Nevine extremely stony silt loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 10 percent of the total acreage of this mapping unit is included areas of Merkel extremely stony sandy loam and Donavan extremely stony loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland. Capability unit VIs–1 dryland; woodland suitability 4x.

121—Nevine extremely stony silt loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 10 percent of the total acreage of this mapping unit is included areas of Merkel extremely stony sandy loam and Donavan extremely stony loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for woodland. Capability unit VIIs–1 dryland; woodland suitability 4x.

Newbon Series

The Newbon series consists of deep, well drained soils that formed in glacial till. These nearly level to very steep soils are on uplands at elevations of 1,800 to 3,000 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, Idaho fescue, big sagebrush, and bitterbrush. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is 49° F., and the frost-free season is 130 to 150 days.

In a representative profile the surface layer is dark grayish brown gravelly loam about 13 inches thick. The subsoil is brown gravelly loam about 12 inches thick. The substratum is light brownish gray gravelly loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is high. Roots penetrate to 60 inches or more.

Newbon soils are used mainly for range, irrigated orchards, hay, pasture, dryland crops, and woodland.

Representative profile of Newbon gravelly loam, 8 to 25 percent slopes, in area of native range 900 feet east and 475 feet north of southwest corner sec. 20, T. 33 N., R. 23 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many roots; many very fine pores; 20 percent gravel; neutral; abrupt smooth boundary.

A12—2 to 13 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak coarse granular structure; slightly hard, very friable, slightly sticky, nonplastic, many roots; many very fine pores; 20 percent gravel; neutral; clear wavy boundary.

B2—13 to 25 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few roots; common very fine pores; 30 percent gravel; neutral; clear smooth boundary.

C—25 to 60 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; massive;

slightly hard, friable, slightly sticky, slightly plastic; few roots; few fine pores; 40 percent gravel; neutral.

Texture of the A horizon ranges from loam to very gravelly loam that can be extremely stony in places. The B and C horizons are gravelly loam or gravelly silt loam.

122—Newbon loam, 3 to 8 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not gravelly. As much as 10 percent of the total acreage of this mapping unit is included areas of Dinkelman loam and Conconully loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 4; range site 5.

123—Newbon loam, 8 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not gravelly. As much as 10 percent of the total acreage of this mapping unit is included areas of Dinkelman loam and Conconully loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IVe–1 irrigated; orchard group 4; range site 5.

124—Newbon loam, 15 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not gravelly. As much as 10 percent of the total acreage of this mapping unit is included areas of Dinkelman loam and Conconully loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IVe–3 dryland, VIe–1 irrigated; orchard group 4; range site 5.

125—Newbon gravelly loam, 0 to 8 percent slopes. As much as 10 percent of the total acreage of this mapping unit is included areas of Dinkelman loam, Conconully gravelly sandy loam, and Newbon loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 4; range site 5.

126—Newbon gravelly loam, 8 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Conconully gravelly sandy loam, Dinkelman gravelly sandy loam, and Newbon loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IVe–3 dryland, IVe–1 irrigated; orchard group 4; range site 5.

127—Newbon gravelly loam, 25 to 45 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Newbon very gravelly loam, eroded, and 10 percent Dinkelman gravelly sandy loam and Conconully gravelly sandy loam. Also included are a few areas where slopes are less than 25 percent.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range. Capability unit VIe–2 dryland; range site 5.

128—Newbon gravelly loam, 25 to 45 percent north slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 4 inches thicker. As much as 10 percent of the total acreage of this mapping unit is included areas of Dinkelman sandy loam and Conconully extremely stony loam, north slopes.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and woodland. Capability unit VIe–2 dryland; range site 5; woodland suitability 4r.

129—Newbon very gravelly loam, 25 to 65 percent slopes, eroded. The profile of this soil is similar to the one described for the series, but the surface layer is very gravelly and is about 8 inches thinner. As much as 15 percent of the total acreage of this mapping unit is included areas of Newbon gravelly loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for range. Capability unit VIIe–1 dryland; range site 4.

130—Newbon extremely stony loam, 0 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 10 percent of the total acreage of this mapping unit is included areas of Conconully extremely stony loam and Dinkelman extremely stony sandy loam.

Runoff is slow to rapid, and the hazard of erosion is slight to high.

This soil is used mainly for range. Capability unit VIs–3 dryland; range site 5.

Nighthawk Series

The Nighthawk series consists of deep, well drained soils formed in glacial till over shale. These gently sloping to very steep soils are on uplands at elevations of 700 to 2,500 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, sand dropseed, and needlegrass. The mean annual precipitation is 8 to 11 inches, the mean annual air temperature is 50° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown extremely stony loam about 8 inches thick. The subsoil is about 14 inches thick. It is brown gravelly loam in the upper 5 inches and light yellowish brown very gravelly loam in the lower 9 inches. The substratum to a depth of 60 inches is pale yellow very gravelly loam and very gravelly coarse sandy loam.

Permeability is moderate. The available water capacity is moderately high. Roots penetrate to 60 inches or more.

Nighthawk soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and range.

Representative profile of Nighthawk extremely stony loam, 8 to 25 percent slopes, in area of range 100 feet

east and 5 feet south of northwest corner SE¼NE¼ sec. 13, T. 37 N., R. 26 E.

A11—0 to 4 inches; grayish brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 5/2) when moist; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; many very fine pores; 30 percent gravel, cobbles and stones; neutral; abrupt smooth boundary.

A12—4 to 8 inches; grayish brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; weak thick platy structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; many very fine pores; 30 percent gravel, cobbles, and stones; neutral; clear smooth boundary.

B2—8 to 13 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; many fine pores; 25 percent gravel; mildly alkaline; clear smooth boundary.

B3—13 to 22 inches; light yellowish brown (10YR 6/4) very gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common roots; common fine pores; 55 percent gravel; mildly alkaline; abrupt wavy boundary.

C1ca—22 to 32 inches; pale yellow (2.5Y 7/4) very gravelly loam, light olive brown (2.5Y 5/4) when moist; massive; hard, friable, slightly sticky, slightly plastic; common roots; common fine pores; 60 percent gravel with strongly effervescent thick lime coatings on undersides; alkaline; abrupt wavy boundary.

C2ca—32 to 60 inches; pale yellow (2.5Y 8/4) weakly lime-cemented very gravelly coarse sandy loam, light yellowish brown (2.5Y 6/4) when moist; massive; hard, friable, nonsticky, nonplastic; few roots; few fine pores; 60 percent gravel; violently effervescent with thin and thick lime coatings on pebbles, cobbles, and stones; numerous soft lime segregations; moderately alkaline.

Depth to the Cca horizon ranges from 18 to 40 inches. The content of coarse fragments range from 5 to 60 percent in the soil profile. Texture of A horizon ranges from extremely stony loam to extremely stony silt loam. In places there are no surface stones. The B horizon ranges from loam to very gravelly loam and from silt loam to very gravelly silt loam. The texture of the C horizon ranges from very gravelly coarse sandy loam to very gravelly loam.

131—Nighthawk loam, 3 to 8 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Conconully loam, and Disautel loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 1; range site 5.

132—Nighthawk loam, 8 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Conconully loam, and Disautel loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IVe–1 irrigated; orchard group 1; range site 5.

133—Nighthawk loam, 15 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Conconully loam, and Disautel loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryland crops, irrigated orchards, hay, pasture, and grazing. Capability unit IVe–3 dryland, VIe–1 irrigated; orchard group 1; range site 5.

134—Nighthawk extremely stony loam, 8 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Conconully loam, and Disautel loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly as range. Capability unit VIs–3 dryland; range site 4.

135—Nighthawk extremely stony loam, 25 to 65 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont extremely stony sandy loam and Disautel extremely stony loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly as range. Capability unit VIIs–1 dryland; range site 4.

136—Nighthawk extremely stony loam, 25 to 65 percent slopes, eroded. The profile of this soil is similar to the one described for the series, but the surface layer is about 4 inches thinner. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont extremely stony loam, Conconully extremely stony loam, Disautel extremely stony loam, and Badland.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly as range. Capability unit VIIs–1 dryland; range site 4.

Okanogan Series

The Okanogan series consists of deep, well drained soils formed in alluvium. These nearly level soils are

on bottom lands and broad alluvial fans at elevations of 700 to 1,500 feet. The native vegetation is mainly bluebunch wheatgrass, Columbia needlegrass, and big sagebrush. The mean annual precipitation is 8 to 11 inches, the mean annual air temperature is about 49° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown loam about 14 inches thick. The next layer is brown loam about 17 inches thick. The underlying material is brown and light brownish gray, stratified silt loam and sandy loam that extends to 60 inches or more.

Permeability is moderate. The available water capacity is moderately high or high. Roots penetrate to 60 inches or more.

These soils are used mainly for irrigated orchards, hay, and pasture. Some areas are used for dryland crops and grazing.

Representative profile of Okanogan loam in orchard 1,100 feet west and 1,200 feet north of southeast corner sec. 5, T. 35 N., R. 27 E.

Ap—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak fine granular structure; soft, very friable, nonsticky, slightly plastic; many roots; many very fine pores; neutral; clear smooth boundary.

A12—3 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak coarse granular structure; soft, very friable, nonsticky, slightly plastic; many roots; many fine and very fine pores; neutral; gradual smooth boundary.

AC—14 to 31 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak prismatic structure; soft, very friable, nonsticky, slightly plastic; common roots; common fine and few medium pores; neutral; gradual wavy boundary.

C1—31 to 45 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common roots; common fine and few medium pores; neutral; abrupt wavy boundary.

C2—45 to 48 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, nonsticky, nonplastic; common roots; common fine and few medium pores; mildly alkaline; abrupt wavy boundary.

C3—48 to 65 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, nonsticky, nonplastic; common roots; common fine pores; slightly effervescent; moderately alkaline.

Gravel content is less than 10 percent throughout the profile. Texture of the A horizon ranges from very fine sandy loam to silt loam. The C horizon ranges from sandy loam to silt loam. Some profiles are stratified with ½- to 3-inch lenses of sand in the lower part of the C horizon.

137—Okanogan loam. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Tonasket silt loam, Colville silt loam, Leavenworth silt loam, and Xerofluvents, wet.

Runoff is very slow, and the hazard of erosion is none to slight. This soil is subject to flooding during spring runoff in years of high snowfall.

This soil is used mainly for irrigated orchards (fig. 6), hay, pasture, and dryland crops. A few small areas are used for range. Capability unit IIIw–1 dryland, IIw–1 irrigated; orchard group 1; range site 5.

138—Okanogan loam, gravelly substratum. The profile of this soil is similar to the one described for the series, but the underlying material is very gravelly sand below a depth of 40 inches. As much as 20 percent of the total acreage of this mapping unit is included areas of fine sandy loam, Tonasket silt loam, Colville silt loam, and Xerofluvents, wet.

Runoff is very slow, and the hazard of erosion is none to slight. The soil is subject to flooding during spring runoff in years of high snowfall.

This soil is used mainly for irrigated orchards, hay, pasture, and dryland crops. A few small areas are used for range. Capability unit IIIw–1 dryland, IIw–1 irrigated; orchard group 1; range site 5.

Owhi Series

The Owhi series consists of deep, well drained soils underlain by very gravelly coarse sand. These nearly level to steep soils are on terraces and terrace escarpments at elevations of 1,400 to 3,000 feet. They formed in glacial outwash. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, and ponderosa pine. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is 49° F., and the frost-free season is 130 to 150 days.

In a representative profile the surface layer is grayish brown fine sandy loam about 8 inches thick. The subsoil is grayish brown sandy loam about 7 inches thick. The upper part of the substratum is brown gravelly sandy loam 16 inches thick, and the lower part is multicolored very gravelly coarse sand that extends to 60 inches or more.

Permeability is moderately rapid to a depth of 31 inches and very rapid below. The available water capacity is low or moderate. Roots penetrate to 60 inches or more.

Owhi soils are used mainly for irrigated orchards, hay, pasture, dryland crops, range, and woodland.

Representative profile of Owhi fine sandy loam, 3 to 8 percent slopes, in area of range 1,450 feet south and 2,700 feet west of northeast corner sec. 30, T. 35 N., R. 26 E.

A1—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 5 percent gravel; neutral; clear smooth boundary.

Figure 6.—**Eight-year-old apple orchard and grass cover crop on Okanogan loam.**

B2—8 to 15 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak medium prismatic structure; soft, very friable, nonsticky, nonplastic; many roots; common fine pores; 5 percent gravel; neutral; clear smooth boundary.

C1—15 to 31 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; massive; soft, very friable, nonsticky, nonplastic; common roots; common fine pores; 20 percent gravel; neutral; clear wavy boundary.

IIC2—31 to 60 inches; multicolored very gravelly coarse sand; single grain; loose when dry and moist; few roots; very porous; 70 percent gravel; neutral.

Depth to unconformable very gravelly and sandy material ranges from 25 to 38 inches. Texture of the A horizon is sandy loam or fine sandy loam that is gravelly or extremely stony in places. The B horizon ranges from sandy loam to fine sandy loam and may be gravelly. The C1 horizon ranges from gravelly coarse sandy loam to gravelly fine sandy loam. The IIC2 horizon ranges from gravelly loamy sand to very gravelly coarse sand.

139—Owhi fine sandy loam, 0 to 3 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Pogue fine sandy loam, Winthrop gravelly loamy sand, Conconully loam, and Haley fine sandy loam.

Runoff is very slow, and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, and dryland crops. A few areas are used for range and woodland. Capability unit IVe–3 dryland, IIe–1 irrigated; orchard group 5; range site 5; woodland suitability 5o.

140—Owhi fine sandy loam, 3 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Pogue fine sandy loam, Winthrop gravelly loamy sand, Conconully loam, and Haley fine sandy loam. Also included are a few areas where slopes are greater than 8 percent.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, and dryland crops. A few areas are used for

range and woodland. Capability unit IVe–3 dryland, IIIe–1 irrigated; orchard group 5; range site 5; woodland suitability 5o.

141—Owhi gravelly fine sandy loam, 0 to 8 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer and subsoil are gravelly. As much as 20 percent of the total acreage of this mapping unit is included areas of Pogue gravelly fine sand. Also included are a few areas where the soil is gravelly or very gravelly within a depth of 25 inches.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, and pasture. A few areas are used as range. Capability unit VIe–2 dryland, IVe–1 irrigated; orchard group 5; range site 5.

142—Owhi gravelly fine sandy loam, 8 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer and subsoil are gravelly. As much as 20 percent of the total acreage of this mapping unit is included areas of Pogue gravelly fine sandy loam, Conconully gravelly sandy loam, and Winthrop gravelly loamy sand.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, and pasture. A few areas are used as range. Capability unit VIe–2 dryland, VIe–1 irrigated; orchard group 5; range site 5.

143—Owhi extremely stony fine sandy loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Pogue extremely stony loam and Winthrop extremely stony loamy sand.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for range. A few irrigated areas where some of the stones have been removed are used for orchards. Capability unit VIs–3 dryland, VIs–1 irrigated; orchard group 6; range site 4.

144—Owhi extremely stony fine sandy loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Pogue extremely stony fine sandy loam, Conconully extremely stony loam, and Winthrop extremely stony loamy sand.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly as range. Capability unit VIIs–1 dryland; range site 4.

Pogue Series

The Pogue series consists of deep, somewhat excessively drained soils underlain by very gravelly sand. These nearly level to very steep soils are on terraces and terrace breaks at elevations of 700 to 1,500 feet. They formed in glacial outwash. The vegetation is mainly bluebunch wheatgrass, needleandthread, and big sagebrush. The mean annual precipitation is 8 to 11 inches, the mean annual air temperature is about 48° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown fine sandy loam about 6 inches thick. The subsoil is brown and yellowish brown fine sandy loam and gravelly fine sandy loam about 23 inches thick. The substratum is multicolored very gravelly sand that extends to 60 inches or more.

Permeability is moderately rapid to a depth of 29 inches and very rapid below. The available water capacity is moderate. Roots penetrate to 60 inches or more.

Pogue soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and range.

Representative profile of Pogue fine sandy loam, 0 to 3 percent slopes, in area of range 1,500 feet west northwest from Omak Airport terminal building across runway and along farm road at a point 50 feet south of road NE¼NE¼NW¼ sec. 11, T. 34 N., R. 26 E.

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak medium platy structure; soft, very friable, slightly sticky, nonplastic; many fine roots; many fine pores; neutral; clear smooth boundary.

B21—6 to 12 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak medium prismatic structure; soft, friable, slightly sticky, nonplastic; common fine roots; common fine pores; neutral; clear smooth boundary.

B22—12 to 29 inches; yellowish brown (10YR 5/4) gravelly fine sandy loam, dark yellowish brown (10YR 3/4) when moist; weak coarse prismatic structure; soft, very friable, nonsticky, nonplastic; common fine roots; common fine pores; 20 percent gravel; neutral; clear smooth boundary.

IIC—29 to 60 inches; multicolored very gravelly sand; single grain; loose when dry and moist; few fine roots; very porous; 55 percent gravel; neutral.

Depth to unconformable very gravelly sandy material ranges from 14 to 36 inches. Texture of the A horizon is sandy loam or fine sandy loam. It is extremely stony in places. The B22 horizon is gravelly sandy loam or gravelly fine sandy loam. The C horizon is 50 to 60 percent gravel.

145—Pogue fine sandy loam, 0 to 3 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Skaha loamy sand, and Owhi fine sandy loam.

Runoff is very slow and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards. (fig. 7), hay, pasture, and range. Some areas are used for dryland crops. Capability unit IVe–3 dryland, IIe–1 irrigated; orchard group 2; range site 3.

146—Pogue fine sandy loam, 3 to 8 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Skaha loamy sand, and Owhi fine sandy loam.

Figure 7.—**Alfalfa cover crop in a young orchard that is surface irrigated. The soil is a nearly level Pogue fine sandy loam.**

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

The soil is used mainly for irrigated orchards, hay, pasture, and range. Some areas are used for dryland crops. Capability unit IVe–3 dryland, IIIe–1 irrigated; orchard group 2; range site 3.

147—Pogue fine sandy loam, 8 to 15 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam, Skaha loamy sand, and Owhi fine sandy loam.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, and range. Some areas are used for dryland crops. Capability unit IVe–3 dryland, IVe–1 irrigated; orchard group 2; range site 3.

148—Pogue fine sandy loam, 15 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont sandy loam and Skaha gravelly loamy sand.

Runoff is medium, and the hazard of erosion and soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, and range. Some areas are used for dryland crops. Capability unit IVe–3 dryland, VIe–1 irrigated; orchard group 2; range site 3.

149—Pogue gravelly fine sandy loam, 0 to 8 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer and the upper part of the subsoil are gravelly. As much as 20 percent of the total acreage of this mapping unit is included areas of Cashmont gravelly sandy loam, Skaha gravelly loamy sand, and Owhi gravelly fine sandy loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, pasture, and range. Capability unit VIe–2 dryland, IVe–1 irrigated; orchard group 2; range site 3.

150—Pogue gravelly fine sandy loam, 8 to 25 percent slopes. The profile of this soil is similar to the one described for the series but is gravelly to a depth of 12 inches. As much as 20 percent of the total acreage of this mapping unit is included areas of Skaha gravelly loamy sand, Cashmont gravelly sandy loam, and Owhi gravelly fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay,

pasture, and range. Capability unit VIe–2 dryland, IVe–1 irrigated; orchard group 2; range site 3.

151—Pogue extremely stony fine sandy loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Cashmont extremely stony loam. Also included are a few areas of soils that have an extremely stony very fine sandy loam surface layer.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for range. A few irrigated areas are used for orchards after some of the stones have been removed. Capability unit VIs–3 dryland, VIs–1 irrigated; orchard group 6; range site 3.

152—Pogue extremely stony fine sandy loam, 25 to 65 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Cashmont extremely stony loam. Also included are a few areas of soils that have an extremely stony very fine sandy loam surface layer.

Runoff is medium to very rapid, and the hazard of erosion is moderate to very high.

This soil is used mainly for range. Capability unit VIIs–1 dryland; range site 3.

Republic Series

The Republic series consists of deep, well drained soils formed in glacial till and alluvium from glacial till. These nearly level to steep soils are on alluvial fans, foot slopes, and uplands at elevation of 3,000 to 4,500 feet. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, and ponderosa pine. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is about 43° F., and the frost-free season is 95 to 100 days.

In representative profile the surface layer is dark gray loam about 16 inches thick. The subsoil is grayish brown gravelly sandy loam about 11 inches thick. The upper 13 inches of the substratum is pale brown gravelly sandy loam. The lower part is pale brown and light yellowish brown gravelly loamy sand that extends to 60 inches or more.

Permeability is moderate to a depth of about 16 inches and increases to very rapid below. The available water capacity is moderate or moderately high. Roots penetrate to 60 inches.

Republic soils are used mainly for range and woodland. Some areas are used for dryland crops.

Representative profile of Republic loam, 15 to 25 percent slopes, 60 feet east and 40 feet south of northwest corner SE¼SE¼NW¼ sec. 1, T. 31 N., R. 22 E.

A1—0 to 16 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) when moist; moderate fine granular structure; soft, very friable, slightly sticky, nonplastic; many roots; many very fine pores; neutral; clear smooth boundary.

B2—16 to 27 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak fine subangular blocky structure; soft, very friable, slightly sticky, nonplastic; many roots; many fine pores; 20 percent gravel; neutral; clear smooth boundary.

C1—27 to 40 inches; pale brown (10YR 6/3) gravelly sandy loam, brown or dark brown (10YR 4/3) when moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; common roots; common fine pores; 20 percent gravel; neutral; clear smooth boundary.

C2—40 to 47 inches; pale brown (10YR 6/3) gravelly loamy sand, brown or dark brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, nonplastic; common roots; porous; 20 percent gravel; neutral; clear smooth boundary.

C3—47 to 60 inches; light yellowish brown (10YR 6/4) gravelly loamy sand, dark yellowish brown (10YR 4/4) when moist; single grain; loose when dry and moist; common roots; porous; 20 percent gravel; neutral.

The content of coarse fragments ranges from 5 to 35 percent throughout the profile. Texture of the A horizon ranges from loam to gravelly sandy loam that can be extremely stony in places.

153—Republic gravelly sandy loam, 3 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly sandy loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Koepke gravelly silt loam, Molson gravelly silt loam, and Mires gravelly loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for range and woodland. Some areas are used for dryland crops. Capability unit IVe–1 dryland; range site 7; woodland suitability 3o.

154—Republic gravelly sandy loam, 15 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is gravelly sandy loam. As much as 20 percent of the total acreage of this mapping unit is included areas of Koepke gravelly silt loam, Molson gravelly loam, and Mires gravelly sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range and woodland. Capability unit IVe–1 dryland; range site 7; woodland suitability 3o.

155—Republic extremely stony sandy loam, 15 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is sandy loam and is 3 to 15 percent stones. As much as 20 percent of the total acreage of this mapping unit is included areas of Molson extremely stony silt loam, Mires extremely stony sandy loam, and Havillah extremely stony silt loam. Also included are a few small areas of Republic gravelly sandy loam.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for range and woodland.

Capability unit VIs–3 dryland; range site 7; woodland suitability 4x.

156—Republic loam, 0 to 8 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Koepke silt loam, Molson silt loam, Mires loam, and Haley fine sandy loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for dryland crops. A few small areas are in woodland and range. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

157—Republic loam, 8 to 15 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Koepke silt loam, Molson silt loam, Mires gravelly loam, and Haley fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryland crops. A few areas are used for range and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

158—Republic loam, 15 to 25 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Koepke silt loam, Molson silt loam, Mires gravelly loam, and Haley fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range and woodland. Some areas are used for dryland crops. Capability unit IVe–1 dryland; range site 8; woodland suitability 3o.

159—Republic loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 2 or 3 inches thicker. As much as 20 percent of the total acreage of this mapping unit is included areas of Koepke silt loam, Molson silt loam, and Havillah silt loam.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and woodland. Capability unit VIe–2 dryland; range site 8; woodland suitability 3r.

160—Republic loam, gravelly substratum, 0 to 8 percent slopes. The profile of this soil is similar to the one described for the series, but the substratum is very gravelly sand. As much as 20 percent of the total acreage of this mapping unit is included areas of Republic gravelly sandy loam, Koepke silt loam, Molson silt loam, and Mires loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for dryland crops. A few small areas are used for range and woodland. Capability unit IIIe–1 dryland; range site 8; woodland suitability 3o.

Riverwash

161—Riverwash consists of nearly level bars of recent coarse sand and gravelly alluvium along perennial and intermittent streams. It is flooded when the streams overflow and is exposed when the water is low. It has a very sparse vegetative cover of brush and deciduous trees.

Riverwash is limited to wildlife habitat. Capability unit VIIIw–1 dryland.

Rock Outcrop

162—Rock outcrop occurs throughout a wide area in the uplands. It is more than 90 percent igneous, either acidic or basic, and sedimentary rock. Less than 10 percent of the mapping unit is very shallow soil material. The vegetation is moss and lichens on the outcrops and scattered, scrubby ponderosa pine, and bluebunch wheatgrass on the very shallow soil material.

Rock outcrop is used for wildlife, watershed, and recreation. Capability unit VIIIs–1 dryland.

Skaha Series

The Skaha series consists of deep, excessively drained soils formed in glacial outwash. These nearly level to very steep soils are on terraces and terrace escarpments at elevations of 700 to 1,500 feet. The native vegetation is mainly needleandthread, bluebunch wheatgrass, and big sagebrush. The mean annual precipitation is 8 to 11 inches, the mean annual air temperature is about 49° F., and the frost-free season is 145 to 178 days.

In a representative profile the surface layer is grayish brown gravelly loamy sand about 7 inches thick. The underlying material, to a depth of 23 inches, is brown and yellowish brown gravelly loamy sand. Beneath this is multicolored very gravelly coarse sand that extends to 60 inches or more.

Permeability is rapid to a depth of about 23 inches and very rapid below. The available water capacity is low. Roots penetrate to 60 inches or more.

Skaha soils are used mainly for irrigated orchards, hay, pasture, and range.

Representative profile of Skaha gravelly loamy sand, 0 to 15 percent slopes, in cultivated area 310 feet west and 110 feet south of northeast corner sec. 35, T. 39 N., R. 27 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry and moist; common roots; porous; 25 percent gravel; neutral; clear smooth boundary.

C1—7 to 13 inches; brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) when moist; single grain; loose when dry or moist; common roots; porous; 30 percent gravel; neutral; abrupt smooth boundary.

C2—13 to 23 inches; yellowish brown (10YR 5/4) gravelly loamy sand, dark yellowish brown (10YR 3/4) when moist; single grain; loose when dry and moist; few roots; porous; 35 percent gravel; neutral; abrupt wavy boundary.

IIC3—23 to 60 inches; multicolored very gravelly coarse sand.

Depth to the very gravelly coarse sand ranges from 18 to 38 inches. The gravel content of the A horizon ranges from 5 to 35 percent. Gravel content of the IIC horizon ranges from 35 to 60 percent by weighted average.

163—Skaha loamy sand, 0 to 8 percent slopes. The

profile of this soil is similar to the one described for the series, but the surface layer is not gravelly. As much as 20 percent of the total acreage of the mapping unit is included areas of Ewall loamy fine sand and Aeneas fine sandy loam.

Runoff is very slow, and the hazard of erosion is none to slight. The hazard of soil blowing is high.

This soil is used mainly for irrigated orchards, hay, pasture, and range. Capability unit VIe–2 dryland, IVe–1 irrigated; orchard group 3; range site 1.

164—Skaha gravelly loamy sand, 0 to 15 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Ewall loamy fine sand, Aeneas fine sandy loam, and Pogue gravelly fine sandy loam.

Runoff is very slow to slow, and the hazard of erosion is none to slight.

This soil is used mainly for irrigated orchards, hay, pasture, and range. Capability unit VIe–2 dryland, VIe–1 irrigated; orchard group 3; range site 1.

165—Skaha gravelly loamy sand, 15 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Pogue gravelly fine sandy loam and Ewall loamy fine sand.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly as range. Capability unit VIe–2 dryland; range site 1.

166—Skaha gravelly loamy sand, 25 to 65 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Pogue gravelly fine sandy loam and Ewall loamy fine sand.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly as range. Capability unit VIIe–1 dryland; range site 1.

Springdale Series

The Springdale series consists of deep, somewhat excessively drained soils underlain by very gravelly sand. These nearly level to steep soils are on terraces and terrace breaks at elevations of 2,000 to 3,500 feet. They formed in glacial outwash. The vegetation is mainly ponderosa pine, Douglas-fir, pinegrass, and Idaho fescue. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is 45° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark gray and dark grayish brown sandy loam about 8 inches thick. It is covered with a thin layer of organic litter. The underlying material to a depth of 30 inches is pale brown gravelly sandy loam. Beneath this to 60 inches or more it is very gravelly sand.

Springdale soils have moderately rapid permeability to about 30 inches and very rapid below. The available water capacity is low or moderate. Roots penetrate to 60 inches or more.

Springdale soils are used mainly for irrigated hay, dryland crops, and woodland.

Representative profile of Springdale sandy loam, 0 to 3 percent slopes, in area of woodland 650 feet south of county road about 4,000 feet northwest of junction with Children Ranch Road in NW¼SW¼NE¼NW¼ sec. 31, T. 35 N., R. 21 E.

O1—1 inch to 0; partially decomposed organic litter of pine needles, leaves, twigs, and cones.

A11—0 to 1 inch; dark gray (10YR 4/1) sandy loam, black (10YR 2/1) when moist; weak thin platy structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 5 percent gravel; neutral; abrupt smooth boundary.

A12—1 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) when moist; weak medium granular structure; soft, very friable, nonsticky, nonplastic; many roots; many very fine pores; 10 percent gravel; neutral; abrupt smooth boundary.

C1—8 to 30 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, nonplastic; common roots; common very fine pores; 35 percent gravel; neutral; clear wavy boundary.

C2—30 to 60 inches; very gravelly sand; 50 percent gravel; neutral.

Depth to the very gravelly sand ranges from 25 to 34 inches. The gravel content increases from about 10 percent in the A horizon to as much as 60 percent in the C2 horizon. Texture of the A horizon ranges from sandy loam to loam that is extremely stony in places.

167—Springdale sandy loam, 0 to 3 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam, Winthrop gravelly loamy sand, and Owhi gravelly fine sandy loam. Also included are a few small areas where the surface layer is gravelly.

Runoff is very slow, and the hazard of erosion is none to slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated hay, dryland crops, and woodland. Capability unit IVe–2 dryland, IVe–1 irrigated; woodland suitability 5f.

168—Springdale sandy loam, 3 to 8 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam, Winthrop gravelly loamy sand, and Owhi gravelly fine sandy loam. Also included are a few small areas where the surface layer is gravelly.

Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated hay, dryland crops, and woodland. Capability unit IVe–2 dryland, IVe–1 irrigated; woodland suitability 5f.

169—Springdale sandy loam, 8 to 25 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam, Winthrop gravelly loamy sand, and Owhi gravelly fine sandy loam. Also included are a few small areas where the surface layer is gravelly.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for woodland. Capability unit VIe–1 dryland; woodland suitability 5f.

170—Springdale extremely stony sandy loam, 0 to 25 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is

3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Kartar extremely stony sandy loam and Winthrop extremely stony loamy sand. Also included are a few areas where the surface layer is gravelly.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland. Capability unit VIs–1 dryland; woodland suitability 5x.

171—Springdale extremely stony sandy loam, 25 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Kartar extremely stony sandy loam and Winthrop extremely stony loamy sand.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for woodland. Capability unit VIs–1 dryland; woodland suitability 5x.

Synarep Series

The Synarep series consists of deep, moderately well drained soils formed in a mantle of volcanic ash and calcareous alluvial sediments. These nearly level soils are on bottom lands at elevations of 1,500 to 3,000 feet. The vegetation is mainly basin wildrye, saltgrass, and bluegrass. The mean annual precipitation is 12 to 15 inches, the mean annual air temperature is 46° F., and the frost-free season is 120 to 135 days.

In a representative profile the surface layer is gray silt loam about 8 inches thick. The underlying material to a depth of 46 inches is light gray and gray silt loam. Beneath this to 60 inches or more it is white sandy loam.

Permeability is moderate. The available water capacity is high. Roots penetrate to 60 inches or more. The seasonal high water table is at a depth of 3 to 4 feet.

Synarep soils are used mainly for dryland crops and range.

Representative profile of Synarep silt loam in area of cropland 660 feet west and 900 feet south of E¼ corner sec. 34, T. 36 N., R. 27 E.

Ap—0 to 8 inches; gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common roots; many fine and very fine pores; violent effervescence; moderately alkaline; abrupt smooth boundary.

AC—8 to 33 inches; light gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) when moist; weak coarse granular structure; slightly hard, friable, slightly sticky, slightly plastic; common roots; common fine and few medium pores; violent effervescence; moderately alkaline; clear smooth boundary.

C1—33 to 46 inches; gray (N 6/0) silt loam, dark gray (N 4/0) when moist; massive; slightly hard, friable, sticky, plastic; few roots; common fine and few medium pores; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIC2—46 to 60 inches; white (2.5Y 8/2) sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; soft, very friable, nonsticky, nonplastic; few roots; few fine pores; mildly alkaline.

This soil is mildly alkaline and moderately alkaline. Texture of the A horizon ranges from very fine sandy loam to silt loam. The C horizon is commonly stratified silt loam, very fine sandy loam, fine sandy loam, or sandy loam. In some places there are 2- to 3-inch thick lenses of gravelly sand.

172—Synarep silt loam. This nearly level soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Colville silt loam, Leavenworth silt loam, and Marsh. Also included are a few areas where the underlying material is strongly alkaline.

Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used for dryland crops, mainly hay and pasture, and range. It is sometimes flooded during runoff in years of high snowfall. Capability unit IVw–1 dryland; range site 2.

Tonasket Series

The Tonasket series consists of deep, well drained soils formed in glacial lake deposits. These nearly level to steep soils are on terraces and terrace breaks at elevations of 700 to 1,500 feet. The vegetation is mainly bluebunch wheatgrass, needleandthread, buckwheat, and big sagebrush. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature is 49° F., and the frost-free season is 145 to 180 days.

In a representative profile the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is pale brown silt loam about 7 inches thick. The substratum is light brownish gray and light gray silt loam that extends to 60 inches or more.

Permeability is moderately slow. The available water capacity is high. Roots pentrate to 60 inches or more.

Tonasket soils are used mainly for irrigated orchards, hay, pasture, dryland crops, and range.

Representative profile of Tonasket silt loam, 3 to 8 percent slopes, in cultivated area NW¼SW¼NE¼ NW¼ sec. 14, T. 30 N., R. 24 E.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak medium platy structure; soft, very friable, slightly sticky, slightly plastic; many roots; many fine and very fine pores; neutral; clear smooth boundary.

B2—8 to 15 inches; pale brown (10YR 5/3) silt loam, brown (10YR 3/3) when moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many roots; many fine and very fine pores; mildly alkaline; clear smooth boundary.

C1—15 to 28 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; many roots; common

fine and few medium pores; mildly alkaline; abrupt wavy boundary.

IIC2ca—28 to 41 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common roots; common fine and few medium pores; discontinuous varves or plates ⅛ to ¼ inch thick; slightly effervescent; moderately alkaline; clear smooth boundary.

IIC3ca—41 to 65 inches; light gray (5Y 7/2) silt loam, grayish brown (5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few roots; common fine and few medium pores; discontinuous varves or plates ⅛ to ¼ inch thick; many thin veins of calcium carbonate; strongly effervescent; strongly alkaline.

Depth to the Cca horizon ranges from 25 to 36 inches. The A and B horizons range from very fine sandy loam to silt loam. In places they are stony. The C horizon ranges from very fine sandy loam to silt loam but includes strata of fine sand or fine sandy loam.

173—Tonasket silt loam, 0 to 3 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Okanogan loam, Cashmere fine sandy loam, and Ewall loamy fine sand. Also included are small areas where the subsoil is silty clay loam and areas where calcium carbonate is at a depth of more than 36 inches.

Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIc–1 dryland, IIe–1 irrigated; orchard group 1; range site 5.

174—Tonasket silt loam, 3 to 8 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Okanogan loam, Cashmere fine sandy loam, and Ewall loamy fine sand. Also included are a few areas where the calicum carbonate is at a depth of more than 36 inches.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IIIe–1 irrigated; orchard group 1; range site 5.

175—Tonasket silt loam, 8 to 15 percent slopes. As much as 15 percent of the total acreage of this mapping unit is included areas of Cashmere sandy loam, Ewall loamy fine sand, and Cashmont sandy loam. Also included are a few small areas where the subsoil is silty clay loam and areas where calcium carbonate is at a depth of more than 36 inches.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IIIe–2 dryland, IVe–1 irrigated; orchard group 1; range site 5.

176—Tonasket silt loam, 15 to 25 percent slopes. As much as 10 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Ewall loamy fine sand, and Cashmont sandy loam. Also included are a few small areas where the calcium carbonate is at a depth of more than 36 inches.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, and range. Capability unit IVe–3 dryland, VIe–1 irrigated; orchard group 1; range site 5.

177—Tonasket silt loam, 25 to 45 percent slopes. As much as 10 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam, Ewall loamy fine sand, and Cashmont sandy loam. Also included are a few areas where calcium carbonate is at a depth of more than 36 inches and a few areas where the surface layer is about 4 inches thinner.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for grazing. Capability unit VIe–2 dryland; range site 5.

178—Tonasket extremely stony silt loam, 0 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 10 percent of the total acreage of this mapping unit is included areas of Cashmere fine sandy loam and Cashmont extremely stony sandy loam. Also included are a few areas where the calcium carbonate is at a depth of more than 36 inches.

Runoff is slow to rapid, and the hazard of erosion is slight to high.

This soil is used mainly for grazing. Capability unit VIs–3 dryland; range site 5.

Vallan Series

The Vallan series consists of shallow, well drained soils underlain by schist and gneiss bedrock. These moderately steep to steep soils are on mountainsides, ridges, and hilltops at elevations of 2,000 to 3,500 feet. They formed in glacial till, a thin mantle of volcanic ash, and material weathered from schist and gneiss. The vegetation is mainly bluebunch wheatgrass, big sagebrush, and scattered ponderosa pine and Douglas-fir. The mean annual precipitation is 12 to 16 inches, the mean annual air temperature is about 43° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is dark brown or brown gravelly silt loam about 4 inches thick. The subsoil is dark brown or brown gravelly silt loam about 11 inches thick over schist bedrock.

Permeability is moderate. The available water capacity is low. Roots penetrate to bedrock.

Vallan soils are used mainly for grazing and woodland.

The Vallan soils in this county are mapped only with Lithic Xerochrepts.

Representative profile of Vallan gravelly silt loam, 400 feet south and 500 feet west of northeast corner sec. 3, T. 40 N., R. 26 E.

A1—0 to 4 inches; dark brown to brown (10YR 4/3) gravelly silt loam, dark brown (10YR 3/3) when moist; weak fine granular structure; soft, very friable,

slightly sticky, slightly plastic; many roots; many very fine and fine pores; 20 percent gravel; neutral; abrupt smooth boundary.

B2—4 to 15 inches; dark brown to brown (10YR 4/3) gravelly heavy silt loam, dark brown (10YR 3/3) when moist; weak medium prismatic structure; soft, very friable, slightly sticky, slightly plastic; common roots; common very fine and fine pores; 20 percent gravel; neutral abrupt smooth boundary.

R—15 inches; schist.

Depth to bedrock ranges from 10 to 20 inches. The content of coarse fragments ranges from 15 to 25 percent.

Wadams Series

The Wadams series consists of deep, well drained soils underlain by cobbly loamy sand. These nearly level to very steep soils are on terraces, terrace fronts, and mountainous uplands at elevations of 1,500 to 3,500 feet. They formed in a mantle of volcanic ash over glacial till. The vegetation is mainly ponderosa pine, bluebunch wheatgrass, Idaho fescue, and bitterbrush. The mean annual precipitation is 15 to 18 inches, the mean annual air temperature is 47° F., and the frost-free season is 120 to 150 days.

In a representative profile the surface layer is gray extremely stony sandy loam about 4 inches thick. The subsoil is pale brown and light brownish gray gravelly sandy loam about 27 inches thick. The substratum is light gray cobbly loamy sand that extends to 60 inches or more.

Permeability is moderately rapid to a depth of about 31 inches and very rapid below. The available water capacity is moderate to moderately high. Roots penetrate to 60 inches or more.

Wadams soils are used mainly for irrigated orchards, hay, pasture, dryland crops, woodland, and grazed woodland.

Representative profile of Wadams extremely stony sandy loam, 25 to 65 percent slopes, 430 feet west and 120 feet south of northeast corner NE¼SE¼SE¼ sec. 30, T. 29 N., R. 23 E.

O1—1 inch to 0; mat of litter, residue from grass and shrubs.

A1—0 to 4 inches; gray (10YR 5/1) extremely stony sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many roots; many very fine pores; 30 percent cobblestones, gravel and stones; 5 percent pumice gravel; neutral; abrupt smooth boundary.

B21—4 to 23 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky, nonplastic; many roots; common very fine pores; few stones and cobbles, 20 percent gravel consisting mostly of pumice; neutral; clear smooth boundary.

B22—23 to 31 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; soft, very friable, slightly sticky, nonplastic; common roots; common very fine pores; 20 percent gravel, consisting mostly of pumice; neutral; clear smooth boundary.

IIC1—31 to 44 inches; light gray (10YR 7/2) cobbly loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky, nonplastic; common roots; few fine pores; 25 percent gravel, consisting mostly of pumice; 15 percent cobbles and stones; neutral; clear smooth boundary.

IIC2—44 to 60 inches; light gray (2.5Y 7/2) cobbly loamy sand, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky, nonplastic; few roots; porous; 20 percent gravel, with some pumice; 20 percent cobbles and stones; neutral.

Depth to unconformable cobbly and sandy material ranges from 24 to 36 inches. The content of gravel-size pumice decreases with increasing depth. Texture of the A horizon is sandy loam and extremely stony sandy loam. Texture of the B horizon ranges from sandy loam to gravelly fine sandy loam. The gravel in the B horizon is predominantly pumice. Texture of the C horizon is cobbly loamy sand or cobbly loamy fine sand.

179—Wadams sandy loam, 3 to 15 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is not stony. As much as 20 percent of the total acreage of this mapping unit is included areas of Kartar sandy loam and Dinkelman sandy loam. Also included are a few areas where slopes are greater than 15 percent, a few areas of soils that are somewhat poorly drained, a few areas where slopes are less than 3 percent, and a few small areas where the surface layer is gravelly.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. The hazard of soil blowing is moderate.

This soil is used mainly for irrigated orchards, hay, pasture, dryland crops, woodland, and grazed woodland. Capability unit IVe–2 dryland, IVe–1 irrigated; orchard group 7; woodland suitability 4o.

180—Wadams extremely stony sandy loam, 0 to 25 percent slopes. As much as 20 percent of the total acreage of this mapping unit is included areas of Kartar extremely stony sandy loam and Dinkelman extremely stony sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for woodland and grazed woodland. Capability unit VIs–1 dryland; woodland suitability 4x.

181—Wadams extremely stony sandy loam, 25 to 65 percent slopes. This soil has the profile described as representative of the series. As much as 20 percent of the total acreage of this mapping unit is included areas of Kartar extremely stony sandy loam and Dinkelman extremely stony sandy loam.

Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used mainly for woodland and grazed woodland. Capability unit VIIs–1 dryland; woodland suitability 4x.

Winthrop Series

The Winthrop series consists of deep, excessively drained soils formed in alluvium. These nearly level to steep soils are on terraces and terrace breaks at elevations of 1,400 to 2,500 feet. The vegetation is mainly bluebunch wheatgrass, big sagebrush, bitterbrush, and ponderosa pine. The mean annual precipitation is 11 to 15 inches, the mean annual air temperature is 46° F., and the frost-free season is 110 to 135 days.

In a representative profile the surface layer is dark grayish brown and grayish brown gravelly loamy sand about 13 inches thick. The underlying material to a depth of 25 inches is brown gravelly loamy sand. Beneath this and extending to a depth of 60 inches it is very gravelly sand.

Permeability is very rapid. The available water capacity is low. Roots penetrate to 60 inches or more.

Winthrop soils are used mainly for irrigated orchards, hay, pasture, and grazed woodland.

Representative profile of Winthrop gravelly loamy sand, 0 to 15 percent slopes, 100 feet west and 50 feet north of southeast corner of NE¼NE¼ sec. 20, T. 33 N., R. 22 E.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark brown (10YR 2/2) when moist; single grain; loose when dry and moist; many roots; porous; 25 percent gravel; neutral; abrupt smooth boundary.

A12—5 to 13 inches; grayish brown (10YR 5/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry and moist; many roots; porous; 25 percent gravel; neutral; abrupt smooth boundary.

C1—13 to 25 inches; brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) when moist; single grain; loose when dry and moist; common roots; porous; 35 percent gravel; neutral; abrupt smooth boundary.

IIC2—25 to 60 inches; very gravelly sand; 50 percent gravel.

Depth to unconformable very gravelly and sandy material is 15 to 33 inches. Gravel content of the A horizon ranges from 25 to 35 percent. This horizon is extremely stony in places. Gravel content of the C horizon ranges from 35 to 55 percent.

182—Winthrop gravelly loamy sand, 0 to 15 percent slopes. This soil has the profile described as representative of the series. As much as 15 percent of the total acreage of this mapping unit is included areas of Ewall loamy fine sand and Owhi gravelly fine sandy loam. Also included are a few small areas where the surface layer is not gravelly and a few areas where the surface layer is less than 7 inches thick.

Runoff is very slow to slow, and the hazard of erosion is none to slight.

This soil is used mainly for irrigated orchards, hay, and pasture. Some areas are used for grazed woodland. Capability unit VIe–2 dryland, IVs–1 irrigated; orchard group 3; woodland suitability 5s.

183—Winthrop extremely stony loamy sand, 0 to 45 percent slopes. The profile of this soil is similar to the one described for the series, but the surface layer is 3 to 15 percent stones. As much as 15 percent of the total acreage of this mapping unit is included areas of Ewall loamy fine sand, Springdale extremely stony sandy loam, and Owhi extremely stony fine sandy loam. Also included are a few areas where the surface layer is less than 7 inches thick.

Runoff is very slow to medium, and the hazard of erosion is none to moderate.

This soil is used mainly for grazed woodland. Capability unit VIs–3 dryland; woodland suitability 5x.

Xerofluvents, wet

184—Xerofluvents, wet, are deep, somewhat poorly drained soils that formed in alluvium. These nearly level soils are on stream terraces and bottom lands at elevations of 1,500 to 4,000 feet. The vegetation is mainly Canada bluegrass, sedges, rushes, and intermittent groves of aspen, cottonwood, and conifers. The mean annual precipitation is 12 to 20 inches, the mean annual air temperature is 42 to 47° F., and the frost-free season is 90 to 130 days.

Typically these soils are stratified erratically but a representative profile has a dark grayish brown fine sandy loam surface layer about 8 inches thick. The underlying material is grayish brown and pale brown fine sandy loam to a depth of about 30 inches. Beneath this it is light yellowish brown loamy sand and multicolored sand that extends to 60 inches or more.

Runoff is very slow and the hazard of erosion is none to slight. These soils are subject to flooding during the spring runoff period in high snowfall years. Depth to a seasonal high water table is 1½ to 3 feet. Roots penetrate to a depth of 60 inches or more.

Xerofluvents, wet, are used mainly for native hay and pasture. Some areas are used for woodland. Capability unit VIw–1 dryland; woodland suitability 2w.

Use and Management of the Soils

This part of the survey explains the capability classification used by the Soil Conservation Service and describes management of the soils, by capability unit, for nonirrigated and irrigated crops grown in the Area. Also on the pages that follow is information on orchards, yields of the principal crops grown in the Area, range, wildlife habitat, woodland, and engineering.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not

take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, soils are grouped at three levels: the capability class, the subclass, and the unit. These levels are described in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use.

Class I soils have few limitations that restrict their use. (There are none of these soils in Okanogan County.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode, but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe–1, or IVe–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitations; the small letter indicates the subclass, or kind of limitations, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The soil series represented in a capability unit is named in the description of the capability unit, but this does not mean that all of the soils of a given series appear in the unit. To find the names of all of the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

On the following pages the capability units in the Okanogan County Area are described and suggestions for the use and management of the soils are given.

Nonirrigated soils

The use and management of nonirrigated soils in Okanogan County Area are governed by climate. A short growing season and lack of summer precipitation limit the number of crops. The principal crops are wheat and barley for grain and grasses and legumes for hay or pasture.

Improving and maintaining soil tilth and controlling erosion and weeds are the basic problems of soil management in Okanogan County. A conservation cropping system is an effective method of solving these problems while providing a favorable economic return to the farmer or rancher.

Stubble mulching, crop residues, minimum tillage, cross slope farming, stripcropping, and terracing on slopes of less than 18 percent reduce the hazard of erosion. Growing alfalfa or grass for hay or pasture and crop residues maintain good soil tilth and the water intake rate. Occasional deep fall chiseling in stubble helps prevent the formation of a tillage pan, increases the depth of moisture penetration, and reduces spring runoff and soil erosion from snowmelt.

Planned waterways should be graded, shaped, packed, and seeded to permanent grass cover.

Grain and hay or pasture crops respond favorably to fertilization but applications should be made according to the available moisture, latest recommendations for the area, and needs of the crop grown.

CAPABILITY UNIT IIIe–1 DRYLAND

This unit consists of deep, well drained and moderately well drained soils of the Donavan, Havillah, Hodgson, Hum, Hunters, Koepke, Molson and Republic series. Permeability is moderate to moderately slow, and the available water capacity is moderate to high. Slopes range from 0 to 20 percent but are mostly less than 15 percent. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation is 13 to 21 inches. The frost-free season is 95 to 130 days.

These soils are used for small grains and alfalfa-grass hay. Wheat and barley are the main grain crops. A common rotation is grain for 3 to 5 years followed by 5 to 10 years of alfalfa.

CAPABILITY UNIT IIIe–2 DRYLAND

This unit consists of deep, well drained soils of the Cashmere, Conconully, Disautel, Nespelem, Newbon, Nighthawk, and Tonasket series. Permeability is moderately rapid to moderately slow. Available water capacity is high. Slopes are 0 to 15 percent. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation is 8 to 15 inches. The frost-free season is 120 to 180 days.

Because of low precipitation, these soils are largely seeded to permanent grass for range, but some areas are used for hay or small grains. Alfalfa and small grains are both grown for hay. Winter wheat is the main grain crop. It is grown on a wheat-fallow, alternate year rotation.

Because of low precipitation, fertilizer application should be adapted to the precipitation and the available water capacity of the soils.

CAPABILITY UNIT IIIw–1 DRYLAND

This unit consists of deep, well drained and moderately well drained soils of the Boesel, Colville, Leavenworth, and Okanogan series. Permeability is moderate to moderately slow. Available water capacity is moderately high to high. Slopes are 0 to 3 percent. Runoff is very slow, and the hazard of erosion is slight. Spring overflow or a fluctuating water table, or both, are common hazards on soils in this unit. The annual precipitation is 8 to 17 inches. The frost-free season is 90 to 180 days.

These soils are used for hay, pasture, and small grains. Alfalfa is the main forage crop, and wheat the principal grain crop. Levees or dikes are needed for flood protection in some areas. Drainage is needed in some areas, but suitable outlets are difficult to obtain because of the low-lying position of these soils. Fertilizer should be applied carefully and at the proper time.

CAPABILITY UNIT IIIc–1 DRYLAND

The soil in this unit is the deep, well drained Tonasket silt loam, 0 to 3 percent slopes. Permeability is moderately slow, and the available water capacity is high. Runoff is very slow, and the hazard of erosion is slight. The annual precipitation is 8 to 12 inches. The frost-free season is 145 to 180 days.

Because of low precipitation, this soil is largely seeded to permanent grass. Some areas are used for hay or small grains on a grain-fallow alternate year rotation. Alfalfa or small grains are used for hay. Winter wheat is the main grain crop. Because of low precipitation, fertilizer application should be carefully adapted to the precipitation and the available water capacity of the soil.

CAPABILITY UNIT IVe–1 DRYLAND

This unit consists of deep, well drained soils of the Havillah, Hunters, Koepke, Mires, Molson, and Republic series. Permeability is moderately slow to moderately rapid. Available water capacity is low to high. Slopes range from 0 to 25 percent but are mostly more than 8 percent. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation is 14 to 18 inches. The frost-free season is 90 to 130 days.

These soils are used for hay, pasture, and small grains. Small grains are usually grown for 2 or 3 years and are followed by 5 to 10 years of alfalfa. Alfalfa and grass is the main hay mixture. Wheat and barley are the main grain crops.

Fertilizer application should be adapted to the precipitation and the available water capacity of the soils.

CAPABILITY UNIT IVe–2 DRYLAND

This unit consists of deep, well drained or somewhat excessively drained soils of the Dinkelman, Donavan, Karamin, Kartar, Leader, Merkel, Nevine, Springdale, and Wadams series. Permeability is rapid, moderately rapid, or moderate. Available water capacity is low to high. Slopes range from 0 to 25 percent but are mostly more than 8 percent. Runoff is very slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation is 14 to 22 inches. The frost-free season is 90 to 150 days.

These soils are wooded, but small areas have been cleared and cultivated in previous years. Most of these cleared areas have been either abandoned or seeded to hay or pasture. Alfalfa and grass is the main hay mixture. Small grains are suitable for 1 or 2 years when reestablishing hay or pasture.

CAPABILITY UNIT IVe–3 DRYLAND

This unit consists of deep, well drained soils of the Aeneas, Cashmere, Cashmont, Conconully, Disautel, Haley, Nespelem, Newbon, Nighthawk, Owhi, Pogue, and Tonasket series. Permeability is moderately slow, moderate, or moderately rapid. Available water capacity is moderately high for most of the soils, but the Owhi soil has low to moderate available water capacity. Slopes range from 0 to 25 percent but are mostly more than 8 percent. Runoff is very slow to medium, and the hazard of erosion is slight to moderate. The annual precipitation is 8 to 15 inches. The frost-free season is 120 to 180 days.

These soils are mostly seeded to permanent grass, but some of the areas are used for hay. Alfalfa and grass is a suitable hay mixture. A common rotation is small grain fallow for 6 years followed by 4 years of alfalfa and grass. Winter wheat is the main small grain.

Because of the low rainfall, fertilizer application must be carefully adapted to the precipitation and the available water capacity of these soils.

CAPABILITY UNIT IVw–1 DRYLAND

This unit consists of deep, somewhat poorly drained and moderately well drained soils of the Colville and Synarep series. Permeability is moderate or moderately slow. Available water capacity is high. Slopes are 0 to 3 percent. Runoff is very slow, and the hazard of erosion is slight. Spring overflow is a hazard. The annual precipitation is 11 to 15 inches. The frost-free season is 120 to 135 days.

These soils are used for hay, pasture, and crops such as barley. Crops should be tolerant to wetness and to salt accumulations.

Levees or dikes are needed for flood protection. Drainage is needed in some areas but is often difficult because of geographic position and the lack of suitable outlets.

Fertilizer should be applied carefully and at the correct time.

CAPABILITY UNIT VIe–1 DRYLAND

This unit consists of deep, well drained and somewhat excessively drained soils of the Dinkelman, Donavan, Kartar, Leader, Molson, Nevine, and Springdale series. Permeability is moderate and moderately rapid. Available water capacity ranges from moderate to high for most of the soils in this unit. The Springdale soil, however, has low to moderate available water capacity. Slopes range from 8 to 65 percent but are mostly more than 25 percent. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. The annual precipitation is 14 to 22 inches. The frost-free season is 90 to 130 days.

The soils in this unit are used mostly for woodland and grazing. Reforestation and range seeding are practical where needed.

CAPABILITY UNIT VIe–2 DRYLAND

This unit consists of deep, excessively drained to well drained soils of the Cashmont, Chesaw, Ewall, Haley, Havillah, Hunters, Koepke, Mires, Nespelem, Newbon, Owhi, Pogue, Republic, Skaha, Tonasket, and Winthrop series. Permeability is very rapid to moderately slow. Some of these soils have a gravelly surface. Available water capacity is low to high. Slopes range from 0 to 45 percent but are mostly more than 25 percent. Runoff is slow to rapid, and the hazard of erosion is slight to high. The annual precipitation is 8 to 18 inches. The frost-free season is 95 to 180 days.

The soils in this unit are used mostly for grazing. Where needed, range seeding is practical in high rainfall areas. Seeding can be difficult because of the slope, the coarse surface texture, or the low available water capacity.

CAPABILITY UNIT VIw–1 DRYLAND

This unit consists of deep, somewhat poorly drained and poorly drained soils of the Emdent series, and Xerofluvents, wet. Permeability is moderate. Available water capacity is high or moderately high. Slopes are 0 to 3 percent. Runoff is very slow to slow, and the hazard of erosion is slight. Overflow is a hazard. The annual precipitation is 11 to 20 inches. The frost-free season is 90 to 135 days.

The soils in this unit are mainly used as woodland or grazed woodland. Drainage is difficult because the soils are on floodplains, and because suitable outlets are seldom available.

CAPABILITY UNIT VIs–1 DRYLAND

This unit consists of deep, somewhat excessively drained and well drained soils of the Dinkelman, Donavan, Havillah, Kartar, Merkel, Nevine, Springdale and Wadams series. The surface layer is 3 to 15 percent stones. Permeability is moderately slow to moderately rapid. Available water capacity is low to high. Slopes are 0 to 45 percent. Runoff is slow to rapid, and the hazard of erosion is slight to high. Annual precipitation is 14 to 22 inches. The frost-free season is 90 to 150 days.

The soils in this unit are mainly used for woodland and grazing. Reforestation is difficult because of surface stones and, in some areas, steep slopes.

CAPABILITY UNIT VIs–2 DRYLAND

The soil in this unit is the deep, moderately well drained Nespelem silt loam, alkali, 0 to 3 percent slopes. Permeability is slow. Available water capacity is high. Runoff is very slow, and the hazard of erosion is slight. The annual precipitation is 11 to 14 inches. The frost-free season is 120 to 135 days.

This soil is used mostly for grazing. Range seeding is feasible where needed. Only plant species with moderate salt tolerance should be seeded.

CAPABILITY UNIT VIs–3 DRYLAND

This unit consists of deep, excessively drained and well drained soils of the Cashmont, Conconully, Disautel, Molson, Newbon, Nighthawk, Owhi, Pogue, Republic, Tonasket, and Winthrop series. Most surface layers are 3 to 15 percent stones. Permeability is very rapid to moderately slow. Available water capacity is low to high. Slopes range from 0 to 45 percent. Runoff is slow to rapid, and the hazard of erosion is slight to high. The annual precipitation is 8 to 18 inches. The frost-free season is 95 to 180 days.

The soils in this unit are used for grazing. Because of surface stones, range seeding is difficult. The available water capacity, rapid and very rapid permeability, slope, and low precipitation also make range seeding difficult on some soils.

CAPABILITY UNIT VIIe–1 DRYLAND

This unit consists of deep, excessively drained and well drained soils of the Cashmere, Ewall, Newbon, and Skaha series. Permeability is moderate or rapid. Available water capacity ranges from low to high. Slopes range from 0 to 65 percent but are mostly more than 25 percent. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The annual precipitation is 8 to 15 inches. The frost-free season is 130 to 180 days.

The soils in this unit are used for grazing. Range improvement depends mostly on grazing systems, time of use, and proper use. Range seeding is a hazard.

CAPABILITY UNIT VIIs–1 DRYLAND

This unit consists of deep, somewhat excessively drained and well drained soils of the Cashmont, Chesaw, Conconully, Dinkelman, Disautel, Donavan, Kartar, Merkel, Mires, Molson, Nevine, Nighthawk, Owhi, Pogue, and Wadams series. Also included are Lithic Xerochrepts in complex units with soils of the Cashmont, Conconully, Donavan, Hum, Kartar, Molson, Nevine, Newbon, Nighthawk, Republic, Vallan, and Wadams series. Surface layers of most soils are 3 to 15 percent stone. Permeability is very rapid to moderate. Available water capacity is very low to high. Slopes range from 0 to 65 percent but mostly are more than 15 percent. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The annual precipitation is 8 to 22 inches. The frost-free season is 90 to 180 days.

The soils in this unit are suited to grazing. Range improvement depends mostly on grazing systems, time of use, and proper use. Range seeding is impractical, because of stones, slopes, low precipitation, or droughty soils.

CAPABILITY UNIT VIIIe–1 DRYLAND

This unit consists of exposed and eroded sediments and gravelly till mapped as Badland. Slopes are mostly more than 45 percent. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mostly by wildlife.

CAPABILITY UNIT VIIIw–1 DRYLAND

This unit consists of very poorly drained and poorly drained Marsh, Riverwash sand, and gravel bars along rivers and streams. Slopes are 0 to 3 percent. These areas are subject to flooding, deposition, and removal when streams overflow. The water table is at or near the surface most of the time.

The unit is used mostly by wildlife.

CAPABILITY UNIT VIIIs–1 DRYLAND

This unit consists of Rock outcrop, which is mainly vertical escarpments of granite and limestone. Slopes are mostly more than 45 percent.

This unit is used mostly by wildlife.

Irrigated soils

About 15,000 acres of Okanogan County Area is irrigated hay and pasture. Less than 1,000 acres is irrigated row crops. Management of the approximately 35,000 acres of irrigated orchards is suggested under the heading "Orchard Groups." Most of the water for irrigation is supplied by perennial streams and storage reservoirs. A small amount is obtained from wells.

Both surface and sprinkler irrigation methods are used in Okanogan County. Surface irrigation is suitable on uniformly sloping soils where slopes are 5 percent or less if the furrows or corrugations are laid out with a slope of 2 percent or less.

Irrigation water management requires a properly planned irrigation system. Length of irrigation runs and rates of water application should be adapted to the respective water intake rates, available water capacities, and slope percentages of the various soils and to the needs of the growing crop.

Land leveling and smoothing are commonly needed to bring irrigated soils to a uniform grade. Growing green manure crops, management of crop residues, crop rotation, minimum tillage, and tillage at the proper moisture content are feasible practices for all irrigated soils in Okanogan County. A suitable crop rotation for most of the soils is 1 to 2 years of corn or other row crop, and 3 to 5 years of hay or pasture. Hay and pasture should be reestablished periodically to maintain production and quality.

Fertilizers are commonly used. The application of fertilizer should be based on the latest reliable recommendations for the area and the soil and the needs of the crop grown.

CAPABILITY UNIT IIe–1 IRRIGATED

This unit consists of well drained, medium textured and moderately coarse textured soils of the Aeneas, Cashmere, Cashmont, Owhi, Pogue, and Tonasket series. Permeability is moderately slow to moderately rapid. Available water capacity is moderate to high in most soils in this unit, but in Owhi soils it is low to moderate. Slopes are 0 to 3 percent. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate for most of the soils, but is slight for Tonasket soils. The frost-free season is 130 to 180 days.

Soils in this unit are suited to potatoes, sweet corn, corn silage, nurseries, small grains, hay, and pasture. Alfalfa and orchardgrass are the main legume and grass plants grown for hay. The soils are also suited to perennial intertilled row crops, such as strawberries and cane berries, and to grass for seed production.

All but Tonasket soils are fine sandy loams and sandy loams that are mainly rapidly permeable. Some require frequent light irrigations for seed germination and crop establishment. Light applications of fertilizers are needed to prevent loss through leaching.

CAPABILITY UNIT IIw–1 IRRIGATED

This unit consists of well drained, medium textured soils of the Okanogan series. These soils are subject to overflow during the spring runoff period of high snowfall years. Permeability is moderate, and the available water capacity is moderately high or high. Slopes are 0 to 3 percent. Runoff is very slow, and the hazard of erosion is slight. The frost-free season is 145 to 180 days.

The soils in this unit are suited to potatoes, sweet corn, silage corn, nurseries, small grains, hay, and pasture. Alfalfa and orchardgrass are the main forage plants. These soils are also suited to perennial intertilled row crops, such as strawberries and cane berries, and to grass for seed production.

Levees or dikes are needed to protect these soils from spring overflow.

CAPABILITY UNIT IIIe–1 IRRIGATED

This unit consists of well drained, medium and moderately coarse textured soils of the Aeneas, Cashmere, Cashmont, Conconully, Disautel, Haley, Leader, Newbon, Nighthawk, Owhi, Pogue, and Tonasket series. Permeability is moderately slow, moderate, or moderately rapid, and the available water capacity ranges from moderate to high for most of the soils. The available water capacity in Owhi soils is low to moderate. Slopes are 0 to 8 percent but are mostly more than 3 percent. Runoff is slow to medium, and the hazard of erosion is slight. The hazard of soil blowing is moderate for the soils with fine sandy loam and sandy loam surface layers, but is slight for the other soils. The frost-free season is 100 to 180 days.

The soils are suited to potatoes, sweet corn, silage corn, and nurseries where slopes are 5 percent or less. Small grains, hay, and pasture are suited to all soils in this unit. Alfalfa and orchardgrass are the main legume and grass plants for hay or pasture. Perennial intertilled row crops, such as strawberries and cane berries, and grass for seed production are also suitable on soils where slopes are 5 percent or less.

Surface irrigation is suitable on slopes of 5 percent or less, if corrugations and furrows are laid out on a

gradient of 2 percent or less. Sprinkler irrigation is suitable on all slopes.

CAPABILITY UNIT IIIw–1 IRRIGATED

This unit consists of well drained and moderately well drained, medium and moderately coarse textured soils of the Boesel and Colville series. Some areas are subject to overflow. Permeability is moderate or moderately slow, and the available water capacity ranges from moderately high to high. Slopes are 0 to 3 percent. Runoff is slow, and the hazard of erosion is slight. The frost-free season is 100 to 135 days.

The soils in this unit are suited to grain sorghums, corn, silage, small grains, hay, and pasture. Where wetness and salt are problems, careful management of irrigation water and applications of fertilizer are needed.

Drainage, salt reclamation, and flood protection are needed on some soils. Levees and dikes protect these soils from overflow. Drainage and salt reclamation are difficult because these soils are low lying and lack suitable drainage outlets.

CAPABILITY UNIT IVe–1 IRRIGATED

This unit consists of excessively drained, somewhat excessively drained, and well drained, coarse, moderately coarse, and medium textured soils of the Aeneas, Cashmere, Cashmont, Conconully, Dinkelman, Ewall, Haley, Kartar, Newbon, Nighthawk, Owhi, Pogue, Skaha, Springdale, Tonasket, and Wadams series. Permeability ranges from moderate to rapid in most of the soils, but is moderately slow in areas of Tonasket soils. Available water capacity ranges from low to high. Slopes are 0 to 25 percent but are mainly more than 8 percent. Runoff ranges from slow to rapid, and the hazard of erosion is slight to moderate. The hazard of soil blowing is high for the Ewall and Skaha soils. The frost-free season is 100 to 180 days.

These soils are mainly used for small grains, hay, and pasture. A suitable crop rotation is 1 year of small grain and 3 to 5 years of hay or pasture.

The soils are best suited to sprinkler irrigation.

CAPABILITY UNIT IVw–1 IRRIGATED

The soil in this unit is a somewhat poorly drained, medium textured Colville silt loam. This soil is subject to spring overflow. Permeability is moderately slow, and the available water capacity is high. Slope is 0 to 3 percent. Runoff is slow, and the hazard of erosion is slight. The frost-free season is 120 to 135 days.

This soil is best suited to hay and pasture. Grain sorghums, silage corn, and small grains are suited to this soil where drainage and flood protection are provided.

Drainage and flood protection are needed and in some areas salt reclamation. Levees and dikes are feasible protection from flooding, but the lack of suitable outlets makes drainage and salt reclamation difficult. Because of the wetness and the salts, very careful water management and fertilizer applications are needed.

CAPABILITY UNIT IVs–1 IRRIGATED

The soil in this unit is the excessively drained, coarse textured Winthrop gravelly loamy sand, 0 to 15 percent slopes. Permeability is very rapid, and the available water capacity is low. Runoff is very slow to slow, and the hazard of erosion is slight. The frost-free season is 100 to 150 days.

The soil in this unit is suited to small grains, hay, and pasture. Small grain is used as a cleanup crop before reestablishing hay and pasture seedings. Cultivation should be limited to 1 or 2 years when reestablishing hay or pasture.

The soil is best suited to sprinkler irrigation. Frequent light irrigations are needed because of the low available water capacity. Light and timely fertilizer applications are needed to prevent loss through leaching.

CAPABILITY UNIT VIe–1 IRRIGATED

This unit consists of excessively drained and well drained, coarse, moderately coarse, and medium textured soils of the Cashmere, Cashmont, Ewall, Newbon, Nighthawk, Owhi, Pogue, Skaha, and Tonasket series. Permeability is moderate to rapid for most of the soils in this unit but is moderately slow in areas of Tonasket soil. Available water capacity ranges from low to high. Slopes are 0 to 25 percent but are mostly 15 to 25 percent. Runoff is slow to rapid, and the hazard of erosion is slight to moderate. The hazard of soil blowing is high for the Ewall soil. The frost-free season is 130 to 180 days.

The soils in this unit are suited to hay and pasture. Alfalfa and orchardgrass are the main forage plants.

These soils are suited to sprinkler irrigation.

CAPABILITY UNIT VIs–1 IRRIGATED

This unit consists of well drained, moderately coarse textured soils of the Cashmont, Owhi, and Pogue series. The surface layer is 3 to 15 percent stones. Permeability is moderately rapid, and the available water capacity is low to moderately high. Slopes are 0 to 25 percent. The runoff is slow to rapid, and the hazard of erosion is slight to moderate. The frost-free season is 130 to 180 days.

The soils are suited to pasture. Alfalfa and orchardgrass are the main legume plants.

These soils are suited to sprinkler irrigation. Surface stones make seedbed preparation and tillage operations difficult. Removal of excessive surface stones is needed in some areas.

Orchard Groups

The soils used for orchard crops in Okanogan County Area are placed into seven orchard groups. Suitable orchard crops are apples, pears, peaches, apricots, and cherries. The soils in each group require about the same kind of management.

The most desirable soil reaction for orchards ranges from pH 6.0 to 7.0. Lime should be added to the soil if the pH is less than 5.5, and ammonium sulfate or ferrous ammonium sulfate should be added if the pH is more than about 7.5. The amount and frequency of applications of fertilizers and soil amendments should follow the recommendations of State and other local agricultural authorities.

Orchard cover crops are effective in reducing water losses from runoff, improving soil structure and tilth,

increasing soil organic matter, and preventing losses from erosion. Perennial cover crops commonly grown are creeping red fescue and orchardgrass. Volunteer grasses, such as quackgrass, Kentucky bluegrass, and redtop, provide suitable protection on soils where slopes are 15 percent or less and where abundant water and a seed source are available.

Sprinkler irrigation is suitable on all soils where slopes are 0 to 25 percent and is essential on coarse textured soils, extremely stony soils, and on soils where slopes are greater than 5 percent. Surface irrigation is suitable where slopes are 0 to 5 percent. Rotobeating and mowing are suitable practices in leaving crop residue on the surface. Soils that could have toxic levels of arsenic should be tested before they are replanted to orchards.

Following is a brief description of the soils in each orchard group and the major needs of management.

Orchard group 1 consists of well drained, medium textured and moderately coarse textured soils of the Cashmere, Cashmont, Nighthawk, Okanogan, and Tonasket series. Soil depth is greater than 40 inches. Slopes range from 0 to 25 percent, but most are less than 15 percent. Elevations are 700 to 2,500 feet. The frost-free season is 145 to 180 days.

The available water capacity is moderately high to high, and permeability is moderately slow to moderately rapid. Runoff is very slow to medium, and the hazard of erosion is slight to moderate.

On mature orchards, 5 to 8.5 inches of water should be applied every 2 to 3 weeks during the growing season.

Orchard group 2 consists of well drained, moderately coarse textured soils of the Aeneas and Pogue series. Depth to coarse textures is 20 to 40 inches. Slopes range from 0 to 25 percent, but most are less than 15 percent. Elevations are 700 to 1,800 feet. The frost-free season is 145 to 180 days.

The available water capacity is moderate to moderately high, and permeability is moderately rapid. Runoff is very slow to medium, and the hazard of erosion is slight to moderate.

On mature orchards, 3 to 4 inches of water should be applied every 5 to 8 days during the growing season.

Orchard group 3 consists of excessively drained, coarse textured soils of the Ewall, Skaha, and Winthrop series. Slopes range from 0 to 25 percent, but most are less than 15 percent. Elevations are 700 to 2,500 feet. The frost-free season is 110 to 180 days.

The available water capacity is low to moderate, and permeability is rapid to very rapid. Runoff is very slow to slow, and the water erosion hazard is slight. The hazard of soil blowing is high on soils with nongravelly surface layers.

On mature orchards, 2 to 4 inches of water should be applied every 3 to 8 days during the growing season.

Orchard group 4 consists of well drained, medium and moderately coarse textured soils of the Conconully, Disautel, and Newbon series. Slopes range from 0 to 25 percent, but most are less than 15 percent. Elevations are 1,500 to 3,000 feet. The frost-free season is 130 to 150 days.

The available water capacity is moderately high to high, and permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

On mature orchards, 6 to 8 inches of water should be applied every 2 to 3 weeks during the growing season.

Orchard group 5 consists of well drained, moderately coarse textured soils of the Haley and Owhi series. Depth to coarse textures is 20 to 40 inches. Slopes range from 0 to 25 percent, but most are less than 8 percent. Elevations are 1,400 to 3,000 feet. The frost-free season is 130 to 150 days.

The available water capacity is low to moderately high, and permeability is moderately rapid. Runoff is very slow to medium, and the hazard of erosion is slight to moderate.

On mature orchards, 2.5 to 4 inches of water should be applied every 5 to 9 days during the growing season.

Orchard group 6 consists of well drained, moderately coarse textured soils of the Cashmont, Owhi, and Pogue series. Coarse fragments are on the surface and throughout the soil. Slopes are 0 to 25 percent. Elevations are 700 to 3,000 feet. The frost-free season is 130 to 180 days.

The available water capacity is low to moderately high, and permeability is moderately rapid to very rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

On mature orchards, 3 to 6 inches of water should be applied every 5 to 14 days during the growing season.

Orchard group 7 consists of well drained and somewhat excessively drained, moderately coarse textured and medium textured soils of the Boesel, Dinkelman, Kartar, Leader, and Wadams series. Slopes range from 0 to 25 percent, but most are less than 15 percent. Elevations are 1,400 to 3,500 feet. The frost-free season is 100 to 150 days. These soils are marginal and submarginal for fruit production. There are isolated areas with desirable climatic conditions.

The available water capacity is moderate to high, and permeability is moderately slow to moderately rapid. Runoff is very slow to medium, and the hazard of erosion is slight to moderate.

On mature orchards, 6 to 9 inches of water should be applied every 2 to 3 weeks during the growing season.

Estimated Yields

The per acre average estimated yields that can be expected of the principal crops under a high level of management are listed in table 2. Yields may be higher or lower than those listed because of seasonal variations in rainfall and other climatic factors in any given year. Absence of a yield estimate indicates that a crop is not suited to or is not commonly grown on the soil, or that irrigation of a given crop is not commonly practiced on the soil.

The estimated yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The latest soil and crop management practices used

TABLE 2.—*Yields per acre of crops and pasture*

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields were estimated for a high level of management in 1971. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Apples		Pears		Wheat, winter		Alfalfa hay		Grass-legume hay		Grass-clover	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Ton*	*Ton*	*Ton*	*Ton*	*AUM* [1]	*AUM* [1]
Aeneas:												
1		835			20	65				6.0		15
2		835			20	65				6.0		15
3		835			20	65				6.0		15
Boesel:												
5					50	55	3.0		3.5	6.0		
Boesel Variant:												
6		670		750		60	1.3	5.0	1.5	6.0		
Cashmere:												
7		835		830	35			6.0		7.0		15
8		835		830	35			6.0		7.0		15
9		835		830	35			6.0		7.0		15
10		720		710	30			5.0		6.0		13
Cashmont:												
12		830		835	20			6.0		7.0		15
13		830		835	20			6.0		7.0		15
14		830		835	20			6.0		7.0		12
15		750		750	20			5.0		6.0		13
16		750		625				5.0		6.0		13
17		750		625				5.0		6.0		13
19		665		625								
Colville:												
23									2.0	5.0		15
24									3.5	6.0		15
Conconully:												
25		835		835				5.0	0.8	6.0		15
26		750		750	20			4.0	0.7	5.0		12
27		835		835	35			5.0	1.3	6.0		15
28		835		835	35			5.0	1.2	6.0		15
29					30				1.0			
Dinkelman:												
33, 35		670			30			4.0	1.2	5.0		
Disautel:												
39		670		750	35				1.3			15
40					35				1.3			
41					25				1.0			
Donavan:												
45					35		1.2		1.2			
46					30		1.0		1.0			
Ewall:												
53, 54		665		750				5.0		6.0		12
Haley:												
56		670		750	25	50		4.0	1.0	5.0		10
57		655		720	25	45		3.5	1.0	4.5		9
Havillah:												
59, 60					40		1.5		2.0			
61					35		1.2		1.8			
Hodgson:												
64					40		1.8		2.0			
Hum:												
65					50		1.6		2.0			

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Apples		Pears		Wheat, winter		Alfalfa hay		Grass-legume hay		Grass-clover	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Ton*	*Ton*	*Ton*	*Ton*	*AUM* [1]	*AUM* [1]
Hunters:												
66, 67					50		1.5		2.0			
68					35		1.5					
Karamin:												
70					25				1.2			
Kartar:												
71		670			25			4.0	0.9	5.0		
72					25				0.9			
Koepke:												
76, 77					45		2.0					
78, 80					40		1.8					
Leader:												
81		670			30			4.0	1.5			
82					25				1.3			
Leavenworth:												
84									2.0			
Merkel:												
98					25		1.0					
Mires:												
103					20		1.1		1.0			
104					20				0.8			
Molson:												
105, 106, 109					40		1.8		2.0			
107					35		1.5		1.8			
Nespelem:												
112, 113					35				1.3			
114, 115					25				1.0			
Nevine:												
118					30		1.1					
Newbon:												
122, 123, 125		665			35		1.0	4.0	1.5	5.0		10
124		500		625	30	45	0.8	3.5	1.0	4.5		9
126		580			30		0.8	4.0	1.0	4.5		9
Nighthawk:												
131		830			35		1.0	5.0	1.2	6.0		15
132		830			35		1.0	5.0	1.2	6.0		15
133		750			30		0.8	4.5	1.0	5.5		14
Okanogan:												
137		835		835	35	65	1.0	6.0	1.2	7.0		15
138		835		835	30	65	1.0	6.0	1.2	7.0		15
Owhi:												
139		665		750	20	50		4.0	1.0	5.0		10
140		665		750	20	50		4.0	0.8	5.0		10
141		580		625		50		4.0		5.0		10
142		580		625		45		3.5		4.5		9
143		500										
Pogue:												
145, 146, 147, 148		835		835	20			5.0	1.0	6.0		15
149, 150		745						4.0		5.0		13
151		745										15
Republic:												
153, 154					30		1.2		1.5			
156, 157					40		1.8		2.0			

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Apples		Pears		Wheat, winter		Alfalfa hay		Grass-legume hay		Grass-clover	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Ton*	*Ton*	*Ton*	*Ton*	*AUM* [1]	*AUM* [1]
158					35		1.5		1.8			
160					30		1.3		1.5			
Skaha:												
163, 164		665		750				5.0		6.0		12
Springdale:												
167					20			5.0	0.8	6.0		
168					20			5.0		6.0		
169					15							
Synarep:												
172									1.0			
Tonasket:												
173, 174, 175		835		835	30		1.0	6.0		7.0		15
176		665		626	25		0.8	5.0		6.0		12
Wadams:												
179		670			25		1.0	4.0		5.0		12
Winthrop:												
182		500						3.0		4.0		10

[1] Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

by many farmers in the county are assumed in estimating the yields. A few farmers may be using more advanced practices and are obtaining average yields higher than those shown in table 2.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. This management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium and trace elements of each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops it is assumed that the irrigation system is adapted to the soils and to the crop grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

Crops other than those shown in table 2 are grown in the survey area, but because their acreage is small, estimated yields for these crops are not given. The Soil Conservation Service and the Cooperative Extension Service can provide information about the productivity and detailed management concerns for all soils and crops grown in the area.

Range [3]

Approximately 71 percent, or 620,000 acres, in the Okanogan County Area is used for range. Range soils are nearly level to strongly sloping and steep, and in places are associated with Rock outcrop. Rangeland dominates the terrain between elevations of 700 and 5,000 feet.

To manage rangeland properly, the operator should know not only the different kinds of soil on his range, but also the present and potential plants each is capable of growing. Soils having the capacity to produce the same kinds, amounts, and proportions of range plants are grouped together into range sites.

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce a characteristic natural plant community. It is the product of all environmental factors responsible for its development, including soil, climate, and vegetation.

The potential or climax vegetation of a range site is the native plant community best adapted to its particular environmental characteristics. These plant communities are relatively stable and are in dynamic equilibrium with the environment.

Abnormal disturbances, such as overuse by livestock, excessive burning, or plowing, result in changes in the climax plant community. Complete destruction of the community could result if disturbance is drastic

[3] By HARMON HODGKINSON, range conservationist, Soil Conservation Service.

enough. If the range site is not deteriorated significantly by water erosion or soil blowing, secondary plant succession progresses in the direction of the natural potential, or climax, plant community for the site.

Range conservationists and soil scientists work as a team to determine the natural potential plant communities for individual soil units and group soils into range sites.

Range condition is the present state of the vegetation or plant community on a range site, as related to the climax plant community for the site. Determining the range condition provides an index of the changes that have taken place in the plant cover. When the potential plant community for a site is known, the present condition can be determined. This provides a basis for predicting the nature and direction of plant community changes to be expected from management and treatment measures.

When changes occur in the climax plant community, because of a particular kind of use or disturbance, some plant species increase and others decrease. How a plant reacts to grazing depends on the kind of grazing animal, the season of use, and the degree to which plant tissue is removed. By comparing the composition of the present condition to the climax plant community, it is possible to see how some individual species have increased while others have decreased. Plants that are not part of the climax community but appear on a deteriorated site are called invaders.

The composition of both the climax and the present plant community together with other range site information, provides the interpretative basis for selecting management objectives, designing grazing systems, managing for wildlife, determining recreation potentials, and evaluating hydrologic conditions.

The management objectives are increasing desirable plants and restoring rangeland to as near climax condition as is reasonably feasible. At times, management objectives may be to create or maintain plant communities somewhat removed from a climax community to fit specific needs in the grazing program or to provide for wildlife habitat or for other benefits. All management objectives must be compatible with conservation objectives, such as providing for plant communities that will protect and improve the soil and water resources, while meeting the desires and needs of the operator.

In the following pages, the range sites of Okanogan County are described, and the major climax plants and principal invaders on the sites are named. An estimate of the potential total annual production of air-dry vegetation for each site when it is in excellent condition is also given. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

RANGE SITE 1

This site is adjacent to or near the Okanogan and Columbia Rivers, dominantly south of Okanogan and between Omak and Tonasket. The soils are coarse textured, excessively drained, and nearly level to steep. Slopes are 0 to 65 percent. Annual precipitation, most of which is in winter, is 8 to 11 inches. Summers are hot and dry. The most favorable growing period for plants is between March 15 and May 31.

There are approximately 16,000 acres in this range site.

The potential vegetation is predominantly needleandthread, smaller amounts of other grasses, and minor amounts of forbs. Scattered shrubs are bitterbrush, big sagebrush, and rabbitbrush.

The approximate species composition by air dry weight of the potential plant community is 80 percent needleandthread, 5 percent bluebunch wheatgrass, 3 percent bitterbrush, 2 percent snow eriogonum, 5 percent Indian ricegrass and Sandberg bluegrass, 3 percent fleabane, balsamroot, phlox, and hawksbeard, and 2 percent big sagebrush and rabbitbrush.

Needleandthread, Indian ricegrass, bluebunch wheatgrass, and bitterbrush decrease under grazing abuse or fire. Less palatable plants, such as buckwheat, phlox, big sagebrush and rabbitbrush, increase. Under continued abuse annual brome, annual fescue, Russianthistle, tarweed, prickly lettuce, and mustard become abundant.

When this site is in excellent condition, the total annual production ranges from 800 pounds per acre in favorable years to 450 pounds in unfavorable years.

This site is subject to soil blowing and trampling by grazing animals during the dry season. It is best suited to late fall and winter grazing. Brush control and seeding are generally not feasible.

RANGE SITE 2

This site is on lowlands. The soils are deep, moderately well drained, medium textured, and nearly level to sloping. They are moderately to strongly alkaline. Slopes are 0 to 3 percent. Annual precipitation, most of which is in winter, ranges from 11 to 15 inches. Summers are hot and dry. The favorable growing period for native plants is between May 1 and July 15.

There are approximately 6,500 acres in this range site.

The climax vegetation is predominantly basin wildrye, smaller amounts of saltgrass, alkali cordgrass, alkali bluegrass, sedges, and rushes and limited amounts of forbs such as bassia, mustard, salsify, and cinquefoil.

The approximate species composition by air dry weight of the potential plant community is 45 percent basin wildrye, 15 percent saltgrass, 10 percent alkali cordgrass, 8 percent rush, 7 percent sedge, 5 percent alkali bluegrass, and 10 percent bassia, mustard, salsify, and cinquefoil.

Basin wildrye and alkali bluegrass decrease under grazing abuse. Saltgrass, sedge, rush, and alkali cordgrass increase. Continued abuse results in the increase of weeds, such as bassia, mustard, thistle, and yarrow.

When this site is in excellent condition, the total annual production ranges from 4,000 pounds per acre in favorable years to 2,000 pounds in unfavorable years.

When the site is in poor condition, seeding an alkali tolerant grass into a well prepared seedbed is feasible. Water erosion and flooding are hazards.

This site is best suited to summer and fall grazing.

RANGE SITE 3

This site is on till plains and outwash terraces. The soils are nearly level to steep, very deep and moderately deep, well drained and somewhat excessively drained, and moderately coarse textured. In places they have a large amount of gravel in the profile and gravel and stones in the surface layer. Slopes are 0 to 65 percent. Annual precipitation, most of which is in winter, ranges from 8 to 12 inches. Summers are hot and dry. The most favorable growing period is from March 15 to June 1.

There are approximately 88,500 acres in this range site.

The climax vegetation is predominantly bluebunch wheatgrass and smaller amounts of needleandthread and Sandberg bluegrass. Also on this site are numerous forbs, such as balsamroot, fleabane, hawksbeard, wild buckwheat, phlox, and biscuitroot, and smaller amounts of bitterbrush, big sagebrush, threetip sagebrush, rabbitbrush, and fringed sagebrush.

The approximate species composition by air dry weight of the potential plant community is 65 percent bluebunch wheatgrass, 15 percent needleandthread, 4 percent Sandberg bluegrass, 3 percent arrowleaf balsamroot, 2 percent each of fleabane, phlox, big sagebrush, bitterbrush, and 5 percent hawksbeard, wild buckwheat, and biscuitroot.

Bluebunch wheatgrass decreases under grazing or other abuse. Needleandthread, Sandberg bluegrass, wild buckwheat, biscuitroot, yarrow, fringed sagebrush, and rabbitbrush increase. Continued abuse results in the eventual domination by cheatgrass, threeawn, annual plantain, and bushy species. Big sagebrush and bitterbrush are killed by fire. Rabbitbrush and threetip sagebrush increase.

When this site is in excellent condition, the total annual production ranges from 1,000 pounds per acre in favorable years to 400 pounds in unfavorable years.

This site is susceptible to trampling and soil blowing when the surface is dry. Water erosion may occur if plant cover is greatly reduced. Seeding and brush control are feasible when needed on all soils except soils with excessive slopes or with many stones.

This site is best suited to fall, winter, and spring grazing.

RANGE SITE 4

The soils of this range site are well drained, moderately coarse textured and medium textured, deep and moderately deep, and very gravelly, cobbly, or extremely stony. Large areas are associated with Rock outcrop and shallow soils. Slopes are 0 to 65 percent. Annual precipitation, most of which is snow, ranges from 8 to 15 inches. Summers are hot and dry. The favorable growing period is from April 1 to June 15.

There are approximately 213,000 acres in this range site.

The climax vegetation is predominantly bluebunch wheatgrass and smaller amounts of Thurber needlegrass, needleandthread, sand dropseed, and Sandberg bluegrass. The forbs are fleabane, biscuitroot, yarrow, balsamroot, snow eriogonum, lupine, and others. The predominant shrubs are bitterbrush and serviceberry and smaller amounts of big sagebrush, threetip sagebrush, rabbitbrush, fringed sagebrush, and horsebrush. A few scattered ponderosa pines are growing on Conconully, Disautel, and Newbon soils.

The approximate species composition by air dry weight of the potential plant community is 60 percent bluebunch wheatgrass, 5 percent each of Thurber needlegrass, needleandthread, Sandberg bluegrass, and sand dropseed, 10 percent balsamroot, lupine, yarrow, snow eriogonum, fleabane, and biscuitroot, and 10 percent fringed sagebrush, big sagebrush, threetip sagebrush, rabbitbrush, and horsebrush.

Bluebunch wheatgrass decreases under abuse. It is replaced by needleandthread, Thurber needlegrass, sand dropseed, balsamroot, snow eriogonum, annual plantain, big sagebrush, and rabbitbrush. As abuse continues, these plants are replaced by weeds, such as cheatgrass, annual fescue, mustard, pigweed, diffuse knapweed, and thistle.

When the range is in excellent condition, the total annual production ranges from 800 pounds per acre in favorable years to 400 pounds in unfavorable years.

This site is subject to water erosion when bare of vegetation and litter. Reseeding and brush control if needed are feasible on the gentle slopes. In reseeding, the deeper soil areas should be selected with care to avoid Rock outcrop, stones, and cobbles.

This site is best suited to spring and fall grazing.

RANGE SITE 5

The soils of this site are well drained, deep, and moderately coarse textured and medium textured. In places gravel and stones are in the surface layer. Underlying materials are gravelly, sandy, or lacustrine sediments. Slopes are 0 to 65 percent. Annual precipitation, most of which is snow, ranges from 8 to 16 inches. Summers are hot and dry. The favorable growing period for native plants is between April 1 and June 30.

There are approximately 148,300 acres in this range site.

The climax vegetation is predominantly bluebunch wheatgrass and Idaho fescue and large amounts of Columbia needlegrass, needleandthread, prairie junegrass, and other grasses. Numerous forbs, such as balsamroot, lupine, yarrow, wild buckwheat, fleabane, and stoneseed, grow on this site. There is also scattered bitterbrush, currant, big sagebrush, threetip sagebrush, and rabbitbrush.

The approximate species composition by air dry weight of the potential plant community is 65 percent bluebunch wheatgrass, 15 percent Idaho fescue, 3 percent each of Sandberg bluegrass and big sagebrush, 2 percent each of threadleaf sedge, lupine, arrowleaf balsamroot, fleabane, and threetip sagebrush, and 4 percent yarrow, wild buckwheat, stoneseed, Helianthella, hawksbeard, and phlox.

Bluebunch wheatgrass, Idaho fescue, and prairie junegrass decrease under range abuse. Such plants as Columbia needlegrass, needleandthread, balsamroot, lupine, big sagebrush, threetip sagebrush, and rabbitbrush increase. Weeds, such as cheatgrass, threeawn, diffuse knapweed, mustard, and thistle, invade if the abuse continues.

When this site is in excellent condition, total annual

production ranges from 1,400 pounds per acre in favorable years to 600 pounds in unfavorable years.

When the range is in poor condition, reseeding is needed on soils that are relatively free of stones and cobbles. A seedbed should be prepared and the seeds drilled. Brush control is feasible where needed. Water erosion is a hazard when the plant cover is greatly reduced.

This site is best suited to late spring, early summer, and fall grazing.

RANGE SITE 6

The soils of this site are well drained, shallow, and medium textured. Slopes are 0 to 45 percent. Annual precipitation, most of which is snow, ranges from 12 to 18 inches. Summers are hot and dry. The favorable growing period for native plants is between April 15 and June 30.

There are approximately 38,000 acres in this range site.

The climax vegetation is predominantly bluebunch wheatgrass and Sandberg bluegrass and some Idaho fescue. Forbs are chiefly phlox, snow eriogonum, fleabane, and balsamroot. There are also a small amount of big sagebrush and horsebrush.

The approximate species composition by air dry weight of the potential plant community is 65 percent bluebunch wheatgrass, 20 percent Sandberg bluegrass, 5 percent Idaho fescue, 2 percent big sagebrush, 1 percent horsebrush, 4 percent phlox, snow eriogonum, fleabane, biscuitroot, pussytoes, and balsamroot, and 3 percent shrubs.

Bluebunch wheatgrass decreases under range abuse. It is replaced by Thurber needlegrass, balsamroot, and big sagebrush. As abuse continues, these plants are replaced by weedy plants, such as cheatgrass, mustard, diffuse knapweed, and thistle.

When the range is in excellent condition, the total annual production ranges from 900 pounds per acre in favorable years to 400 pounds in unfavorable years.

Reseeding is not feasible because of shallow soils, rock outcrop, and steep topography.

This site is best suited to spring and fall grazing.

RANGE SITE 7

In this site are well drained and somewhat excessively drained, deep and shallow, moderately coarse textured and medium textured soils that have gravel and sand in the profile. Slopes are 9 to 65 percent. Annual precipitation, most of which is in winter and spring, ranges from 14 to 18 inches. Summers are warm and dry. Some storms occur. The favorable growing period for native plants is between May 1 and June 30.

There are approximately 12,500 acres in this range site.

The climax vegetation is predominantly bluebunch wheatgrass and Idaho fescue, smaller amounts of rough fescue, threadleaf sedge, Sandberg bluegrass, and others. Forbs include lupine, cinquefoil, pussytoes, wild buckwheat, and hawksbeard. There is also a small amount of rose, snowberry, rabbitbrush, and currant.

The approximate species composition by air dry weight of the potential plant community is 65 percent bluebunch wheatgrass, 15 percent Idaho fescue, 5 percent rough fescue, 2 percent each of the arrowleaf balsamroot, lupine, and rose, 1 percent snowberry, 3 percent Sandberg bluegrass, prairie junegrass, and Columbia needlegrass, 3 percent rabbitbrush and currant, and 2 percent cinquefoil, pussytoes, wild buckwheat, yarrow, stoneseed, hawksbeard, and strawberry.

Bluebunch wheatgrass, Idaho fescue, and rough fescue decrease under range abuse. Less desirable plants, such as Columbia needlegrass, Sandberg bluegrass, lupine, yarrow, ninebark, and rabbitbrush, increase. Continued abuse eliminates the climax species, and weedy plants, such as cheatgrass, mustard, thistle, and knapweed, invade the site.

When the range is in excellent condition, the total annual yield ranges from 1,200 pounds per acre in favorable years to 600 pounds in unfavorable years.

Reseeding if needed is feasible on the gently sloping soils. A seedbed should be prepared and seeds drilled where possible. In areas too stony to till, the seed can be broadcast.

This site is best suited to summer and fall grazing.

RANGE SITE 8

In this site are well drained, medium textured, deep and very deep soils that have an ash mantle and formed in glacial till and outwash. On most of the site the soils are extremely stony or are associated with Rock outcrop. Slopes are 0 to 45 percent. Annual precipitation, most of which is in winter and spring, ranges from 14 to 18 inches. The favorable growing period for native plants is between May 1 and July 15. Summers are warm and dry. Some storms occur.

There are approximately 97,200 acres in this range site.

The climax vegetation is dominated by about equal amounts of bluebunch wheatgrass and Idaho fescue and smaller amounts of prairie junegrass, mountain brome, and threadleaf sedge. Forbs include lupine, fleabane, penstemon, pussytoes, balsamroot, stoneseed, strawberry, and hawksbeard. Threetip sagebrush, rose, snowberry, shrubby cinquefoil, and rabbitbrush also grow on this site.

The approximate species composition by air dry weight of the potential plant community is 35 percent bluebunch wheatgrass, 30 percent Idaho fescue, 7 percent rough fescue, 3 percent lupine, 2 percent each of Wyeth buckwheat and geranium, 10 percent prairie junegrass, mountain brome, and Columbia needlegrass, 6 percent fleabane, penstemon, pussytoes, balsamroot, stoneseed, hawksbeard, and yarrow, and 5 percent threetip sagebrush, rose, snowberry, shrubby cinquefoil, and rabbitbrush.

Bluebunch wheatgrass, Idaho fescue, and rough fescue decrease under range abuse. Less desirable plants, such as Sandberg bluegrass, Columbia needlegrass, lupine, buckwheat, yarrow and threetip sagebrush, increase. Continued abuse eliminates the climax species, and seedy plants, such as cheatgrass, mustard, thistle, and knapweed, increase.

When the range is in excellent condition, the total annual yield ranges from 2,400 pounds per acre in favorable years to 1,000 pounds in unfavorable years.

Water erosion is a hazard if the plant cover is removed.

When the range is in poor condition, reseeding is practical. A seedbed should be prepared, and the seeds drilled. In areas too stony or rocky the seed can be broadcast.

This site is best suited to summer and fall grazing.

Wildlife[4]

The Okanogan County Area with its range in climate, vegetation, terrain, and abundance of water provides abundant wildlife habitat. Originally, deer, bear, cougar, porcupine, native grouse, and songbirds dominated the timbered slopes and open prairies; mountain goats and sheep occupied the rocky cliffs in the northwest corner of the Area; and beaver and muskrats made homes along the streams. Trout were abundant in the cool clear ponds, lakes, and streams.

With the increase in population and the changing cultural practices, the natural habitat has decreased. New wildlife species, such as pheasant, gray partridge, California quail, and chukars, have been introduced. Mountain sheep have been re-introduced. The Okanogan Valley is still one of the most popular hunting and fishing regions of the State, but good management is needed to retain and improve wildlife habitat.

Wildlife populations depend on the availability of food, cover, and water in suitable combinations. Successful management depends on the ability of the soil to produce the plants needed for the desired wildlife.

Soil properties that affect wildlife habitat are thickness of soil useful to crops, surface texture, available water capacity, wetness, surface stoniness or rockiness, flood hazard, and slope. The climate, use of the area, present use of the soil, or elevation and aspect are not considered. All must be appraised onsite.

A wildlife habitat potential is rated in table 3. Four levels of soil suitability are recognized: good, fair, poor, and very poor.

A rating of *good* means that the soil is well suited to the element of wildlife habitat and that habitat generally is easily created, improved, and maintained. Few or no limitations affect management, and satisfactory results are expected when the soil is used for its prescribed purpose.

A rating of *fair* means that the soil is suited to wildlife habitat and that habitat can be created, improved, or maintained in most places. Moderate management and fairly frequent attention may be needed to produce satisfactory results.

A rating of *poor* means that the soil is poorly suited to wildlife and that limitations are severe. Habitat can be created, improved, or maintained in most places, but management is difficult and expensive and requires intensive effort.

A rating of *very poor* means that the soil is unsuited to wildlife habitat and that unsatisfactory results can be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils rated *very poor*.

Habitat elements rated in table 3 are defined as follows:

Grain and seed crops are annual grain or seed-producing plants, such as wheat, barley, millet, and peas, planted to produce food for wildlife.

Grasses and legumes are domestic grasses and legumes that are established by planting to provide food and cover for wildlife. Alfalfa, sweet clover, several species of wheatgrass, and fescues are examples.

Wild herbaceous plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for wildlife. Examples are balsamroot, fescue, cheatgrass, and many species of weeds.

Coniferous trees and shrubs are cone-bearing trees used mainly as cover, but may provide food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment, but can be planted. Pines, cedars, firs, and ornamental trees are typical examples.

Shrubs are woody plants that provide food or cover, or both, for many species of wildlife. Plants can be native or introduced. Typical species are rabbitbrush, sagebrush, native rose, and snowberry.

Wetland plants are annual or perennial herbaceous plants that generally grow wild on moist or wet sites. They provide food and cover for many wetland wildlife species. Cattails, bulrush, smartweed, and burreed are examples.

Shallow water developments are areas of shallow water, generally less than 5 feet deep, that are useful to wildlife. Some are designed with water level controls. Others may be permanent impoundments that provide conditions for growing wetland plants.

The suitability for four general kinds of wildlife habitat also is shown in table 3.

Openland wildlife are birds and mammals that normally live in meadows, pasture, and other open areas. California quail, ring-necked pheasant, dove, meadow lark, and horned lark are some examples.

Woodland wildlife are birds and mammals that generally live in areas of trees and shrubs. Examples are squirrel, racoon, deer, thrushes, vireos, and other birds.

Wetland wildlife are ducks, geese, shorebirds, muskrat, and other animals and birds that normally live in wetlands, marshes, and sloughs.

Rangeland wildlife are birds and mammals that normally live in natural rangelands. Examples are chukar, deer, coyote, meadowlark, and lark bunting.

Woodland[5]

In the past, the production of wood products was considered the primary use of forest land. Now, much of the private forest land is managed as grazed woodland.

Values other than wood products are influencing the use and management of forest land. Hunting, fishing, camping, and other recreation are having a marked effect on the management of public lands. Investment in land for recreation is causing a sharp increase in the price of private forest land.

Types of woodland.—The lower valleys, commonly private land, support stands of ponderosa pine and a bunchgrass understory. Grazing is an important use.

As the elevation increases, the benches, terraces, and foot slopes support mixed stands of ponderosa

[4] By LEROY A. SHEARER, biologist, Soil Conservation Service.

[5] By R. J. OLSON, woodland specialist, Soil Conservation Service.

TABLE 3.—*Wildlife habitat potentials*

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Aeneas:												
1, 2, 3	Fair	Fair	Fair			Fair	Poor	Very poor.	Fair		Very poor.	Fair.
Badland:												
4												
Boesel:												
5	Fair	Fair	Good		Good	Good	Poor	Poor	Fair	Good	Poor	
Boesel Variant:												
6	Fair	Fair	Good		Good	Good	Poor	Fair	Fair	Good	Poor	
Cashmere:												
7												
8, 9	Fair	Good	Good			Good	Very poor.	Very poor.	Good		Very poor.	Good.
10	Poor	Poor	Good			Good	Very poor.	Very poor.	Poor		Very poor.	Good.
11	Very poor.	Poor	Good			Good	Very poor.	Very poor.	Poor		Very poor.	Good.
Cashmont:												
12	Good	Good	Good			Good	Poor	Poor	Good		Poor	Good.
13, 14, 16, 17	Fair	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
15	Poor	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
18												
19	Poor	Poor	Fair			Fair	Very poor.	Very poor.	Fair		Very poor.	Fair.
20	Very poor.	Very poor.	Fair			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
Chesaw:												
21	Poor	Poor	Fair			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
22	Very poor.	Very poor.	Fair		Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Colville:												
23	Poor	Fair	Fair		Good	Fair	Good	Fair	Fair	Fair	Fair	
24	Fair	Fair	Good			Good	Poor	Poor	Fair		Poor	Good.
Conconully:												
25, 26, 27, 28, 29	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
30	Poor	Poor	Good			Fair	Very poor.	Very poor.	Fair		Very poor.	Fair.
31	Very poor.	Very poor.	Good			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
Conconcully:												
32	Very poor.	Very poor.	Good		Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Dinkelman:												
33, 35	Fair	Good	Good		Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	
34, 38	Poor	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	
36	Poor	Poor	Good		Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	
37	Very poor.	Very poor.	Good		Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	

TABLE 3.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Disautel:												
39, 40, 41	Fair	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
42	Poor	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
43	Poor	Poor	Good			Poor	Very poor.	Very poor.	Fair		Very poor.	Fair.
44	Very poor.	Very poor.	Good			Poor	Very poor.	Very poor.	Fair		Very poor.	Fair.
Donavan:												
45	Fair	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	
46	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	
47	Poor	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	
48	Poor	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
49	Very poor.	Very poor.	Good		Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	
[1] 50:												
Donavan part	Very poor.	Very poor.	Good		Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	
Rock outcrop part												
Emdent:												
51	Poor	Poor	Good		Good	Good	Fair	Poor	Fair	Good	Poor	
Ewall:												
52	Very poor.	Very poor.	Fair			Good	Very poor.	Very poor.	Poor		Very poor.	Fair.
53	Fair	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
54, 55	Poor	Poor	Fair			Good	Very poor.	Very poor.	Poor		Very poor.	Fair.
Haley:												
56, 57	Fair	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
58	Poor	Fair	Good			Good	Very poor.	Very poor.	Fair		Very poor.	Good.
Havillah:												
59, 60, 61	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
62	Poor	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
63	Poor	Poor	Good		Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Hodgson:												
64	Fair	Fair	Poor		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	
Hum:												
65	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Good		Very poor.	Good.
Hunters:												
66, 67, 68	Fair	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
69	Poor	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Karamin:												
70	Fair	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	

TABLE 3.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Kartar:												
71, 72	Fair	Fair	Good		Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
73, 75	Very poor.	Very poor.	Good		Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
74	Poor	Poor	Good		Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Koepke:												
76, 77, 80	Fair	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
78	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
79	Poor	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Leader:												
81, 82	Fair	Fair	Good		Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	
83	Poor	Fair	Good		Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	
Leavenworth:												
84	Fair	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	
Lithic Xerochrepts:												
[1]85:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor			Poor	Very poor.	Very poor.	Very poor.		Very poor.	Poor.
Cashmont part	Very poor.	Very poor.	Fair			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
[1]86:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor			Poor	Very poor.	Very poor.	Very poor.		Very poor.	Poor.
Conconully part	Very poor.	Very poor.	Good			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
[1]87:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor			Poor	Very poor.	Very poor.	Very poor.		Very poor.	Poor.
Donavan part	Very poor.	Very poor.	Good		Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	
Rock outcrop part												
[1]88:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor			Poor	Very poor.	Very poor.	Very poor.		Very poor.	Poor.
Hum part	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Good		Very poor.	Good.
[1]89:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor			Poor	Very poor.	Very poor.	Very poor.		Very poor.	Poor.

TABLE 3.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Kartar part	Very poor.	Very poor.	Good	———	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
[1]90:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Molson part	Very poor.	Very poor.	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
[1]91:												
Lithic Xerochrepts part	Very. poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Nevine part	Very poor.	Very poor.	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	———
[1]92:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Newbon part	Very poor.	Very poor.	Good	———	———	Fair	Very poor.	Very poor.	Poor	———	Very poor.	Fair.
[1]93:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Nighthawk part	Very poor.	Very poor.	Fair	———	———	Fair	Very poor.	Very poor.	Very poor.	———	Very poor.	Fair.
[1]94:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Republic part	Very poor.	Very poor.	Good	———	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
[1]95:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Vallan part	Very poor.	Very poor.	Fair	———	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
[1]96:												
Lithic Xerochrepts part	Very poor.	Very poor.	Poor	———	———	Poor	Very poor.	Very poor.	Very poor.	———	Very poor.	Poor.
Wadams part	Very poor.	Very poor.	Good	———	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	———
Marsh:												
97	———	———	———	———	———	———	———	———	———	———	———	———
Merkel:												
98	Fair	Fair	Good	———	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	———
99	Poor	Fair	Good	———	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	———

TABLE 3.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
100	Very poor.	Very poor.	Fair	———	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	———
Mires:												
101	Poor	Fair	Fair	———	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
102	Very poor.	Very poor.	Fair	———	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
103, 104	Fair	Fair	Fair	———	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Molson:												
105, 106, 109	Fair	Fair	Good	———	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
107	Fair	Fair	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
108, 110	Poor	Fair	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
111	Very poor.	Very poor.	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Nespelem:												
112, 113, 114, 115	Fair	Fair	Good	———	———	Good	Very poor.	Very poor.	Fair	———	Very poor.	Good.
116	Poor	Fair	Good	———	———	Good	Very poor.	Very poor.	Fair	———	Very poor.	Good.
117	Poor	Poor	Fair	———	———	Fair	Poor	Poor	Poor	———	Poor	Fair.
Nevine:												
118	Fair	Fair	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	———
119, 120	Poor	Fair	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	———
121	Very poor.	Very poor.	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	———
Newbon:												
122, 123, 124, 125, 126	Fair	Fair	Good	———	———	Good	Very poor.	Very poor.	Fair	———	Very poor.	Good.
127	Poor	Fair	Good	———	———	Good	Very poor.	Very poor.	Fair	———	Very poor.	Good.
128	Poor	Fair	Good	———	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
129	Very poor.	Very poor.	Good	———	———	Good	Very poor.	Very poor.	Poor	———	Very poor.	Good.
130	Poor	Poor	Good	———	———	Fair	Very poor.	Very poor.	Fair	———	Very poor.	Fair.
Nighthawk:												
131, 132, 133	Fair	Fair	Fair	———	———	Fair	Very poor.	Very poor.	Fair	———	Very poor.	Fair.
134, 135, 136	Very poor.	Very poor.	Fair	———	———	Fair	Very poor.	Very poor.	Very poor.	———	Very poor.	Fair.
Okanogan:												
137	Good	Good	Good	———	———	Good	Poor	Poor	Good	———	Very poor.	Good.
138	Good	Good	Good	———	———	Good	Poor	Poor	Good	———	Poor	Good.
Owhi:												
139, 140	Fair	Fair	Good	———	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
141	Fair	Fair	Good	———	———	Good	Very poor.	Very poor.	Fair	———	Very poor.	Good.
Owhi:												
142	Poor	Fair	Good	———	———	Good	Very poor.	Very poor.	Fair	———	Very poor.	Good.

TABLE 3.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
143, 144	Very poor.	Very poor.	Good			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
Pogue:												
145, 146, 147, 148	Fair	Fair	Fair			Fair	Very poor.	Very poor.	Fair		Very poor.	Fair.
149, 150	Poor	Poor	Fair			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
151, 152	Very poor.	Very poor.	Fair			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
Republic:												
153, 156, 157, 160	Fair	Fair	Good		Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
154, 158	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
155	Very poor.	Very poor.	Good		Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
159	Poor	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Riverwash:												
161												
Rock outcrop:												
162												
Skaha:												
163, 164	Fair	Fair	Fair			Fair	Very poor.	Very poor.	Fair		Very poor.	Fair.
165	Poor	Poor	Poor			Poor	Very poor.	Very poor.	Poor		Very poor.	Poor.
166	Very poor.	Very poor.	Poor			Poor	Very poor.	Very poor.	Very poor.		Very poor.	Poor.
Springdale:												
167, 168, 169, 170, 171	Poor	Poor	Fair		Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	
Synarep:												
172	Poor	Fair	Good			Good	Poor	Poor	Fair		Poor	Good.
Tonasket:												
173, 174	Fair	Fair	Fair			Fair	Poor	Very poor.	Fair		Very poor.	Fair.
175, 176	Fair	Fair	Fair			Fair	Very poor.	Very poor.	Fair		Very poor.	Fair.
177	Poor	Poor	Fair			Fair	Very poor.	Very poor.	Poor		Very poor.	Fair.
178	Very poor.	Very poor.	Fair			Fair	Very poor.	Very poor.	Very poor.		Very poor.	Fair.
Wadams:												
179	Fair	Fair	Good		Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	
180, 181	Very poor.	Very poor.	Good		Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	
Winthrop:												
182	Fair	Fair	Fair		Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	
183	Very poor.	Very poor.	Fair		Poor	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	
Xerofluvents:												
184	Poor	Poor	Fair		Fair	Fair	Fair	Fair	Poor	Fair	Fair	

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

pine and Douglas-fir. In these areas the aspect, or direction of slope, is an important factor affecting the composition of the forest stand. Ponderosa pine, for example, is common on the south- and west-facing slopes. Douglas-fir is common on north- and east-facing slopes. As the amount of available water increases and spring frost becomes more severe, lodgepole pine and larch are common in the stands. This forest land is mixed public and private ownerships.

At the higher elevations, Douglas-fir, larch, and lodgepole pine are most common. Cedar, Engelmann spruce, and grand fir grow on the high valley floors. Subalpine fir is also found at the higher altitudes. Most forest land at the higher elevations is in public ownership.

Aspen occurs in small stands or patches throughout the Area. Cottonwood is common in the lower valleys. Changes in vegetation are markedly affected by variations in elevation, soils, aspect, and moisture. The understory and overstory vegetation are excellent indicators of these ecological changes.

Woodland management.—The information in the paragraphs that follow and in table 4 relates to the private forest land in the Okanogan County Area. This information is from limited soil-site study plots and onsite observations. Published regional site curves (*5*) were used to determine the woodland productivity ratings. Table 4 lists the productivity, management hazards, and plant associations for each soil in the survey area.

Woodland suitability is designated by a two part symbol, for example, 3o, 4x, or 5f.

The potential productivity of the soils in the group is indicated by the first number. The numeral *1* means very high, *2* high, *3* moderately high, *4* moderate, and *5* low. Potential productivity is based on field determination of the site index, or the height in feet that the taller trees of a given species in a natural stand will reach in a stated number of years on a specified soil.

The second part of the symbol is a small letter. The letter *d* means that root depth is restricted. The letter *f* indicates fragmental soils, or droughty soils that have excessive amounts of rock fragments. The letter *o* means that the soils have few limitations restricting their use for trees. The letter *r* indicates a slope of 30 percent or more. The letter *s* indicates sandy soils that have low available water capacity. The letter *w* means excessive wetness, either seasonal or all year. Such soils have restricted drainage, have a high water table, or are subject to flooding. The letter *x* indicates a limitation for woodland use or management because of stones or rock outcrop.

Hazards or limitations in management are expressed as slight, moderate, or severe.

Erosion hazard indicates the degree of potential erosion. *Slight* means that the problems of erosion are unimportant. *Moderate* indicates that some attention must be given to prevent soil erosion. *Severe* means that intensive management, specialized equipment, and methods of logging must be planned to minimize soil erosion.

Equipment limitation refers to those soil characteristics that restrict the use of harvesting equipment. *Slight* indicates no restriction in the kind of equipment or the time of year it is used; *moderate* means that use of equipment is restricted for 3 months; and *severe* means that its use is severely restricted for more than 3 months of the year.

Seedling mortality refers to loss of seedlings because of unfavorable soil or topographic conditions. Plant competition is not a factor. *Slight* means a loss of 0 to 25 percent, *moderate* a loss of 25 to 50 percent, and *severe* a loss of more than 50 percent.

Plant competition is the degree to which undesirable plants invade openings in the tree canopy. *Slight* means that plant competition does not prevent adequate natural regeneration and early growth or interfere with seedling development. *Moderate* means that competition delays natural or artificial establishment growth rate but does not prevent the development of a fully stocked normal stand. *Severe* means that competition prevents adequate natural or artificial regeneration unless the site is prepared properly and maintained by burning, spraying, disking, or girdling as needed.

Table 4 also lists suitable species for planting, the site index, and native trees that will probably be the best for replanting.

Recreation

The soils of the survey area are rated in table 5 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 5 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 7, and interpretations for dwellings without basements and for local roads and streets, given in table 6.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet

TABLE 4.—*Woodland management and productivity*

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Boesel:								
5	2o	Slight	Slight	Slight	Moderate	Douglas-fir	113	Douglas-fir, ponderosa pine.
						Ponderosa pine	111	
Boesel Variant:								
6	2o	Slight	Slight	Slight	Moderate	Douglas-fir	113	Douglas-fir, ponderosa pine.
						Ponderosa pine	111	
Colville:								
23	2w	Slight	Moderate	Slight	Moderate	Black cottonwood	-------	Black cottonwood.
Conconully:								
25, 27	5o	Slight	Slight	Severe	Slight	Ponderosa pine	63	Ponderosa pine.
26, 28, 29	5o	Moderate	Slight	Severe	Slight	Ponderosa pine	63	Ponderosa pine.
32	5x	Severe	Severe	Moderate	Slight	Douglas-fir	63	Douglas-fir.
Dinkelman:								
33, 35	5o	Moderate	Moderate	Severe	Moderate	Douglas-fir	71	Douglas-fir, ponderosa pine.
						Ponderosa pine	64	
34, 38	5r	Severe	Moderate	Severe	Moderate	Douglas-fir	71	Douglas-fir, ponderosa pine.
						Ponderosa pine	64	
36	5x	Moderate	Moderate	Severe	Severe	Ponderosa pine	64	Ponderosa pine, Douglas-fir.
						Douglas-fir	71	
37	5x	Severe	Severe	Severe	Severe	Ponderosa pine	64	Ponderosa pine, Douglas-fir.
						Douglas-fir	71	
Donavan:								
45	4o	Slight	Slight	Slight	Slight	Ponderosa pine	77	Ponderosa pine.
46	4o	Moderate	Slight	Slight	Slight	Ponderosa pine	77	Ponderosa pine.
47	4r	Severe	Severe	Moderate	Slight	Ponderosa pine	77	Ponderosa pine.
48	4x	Moderate	Moderate	Severe	Slight	Ponderosa pine	77	Ponderosa pine.
49	4x	Severe	Severe	Severe	Slight	Ponderosa pine	77	Ponderosa pine.
[1]50:								
Donavan part	4x	Severe	Severe	Severe	Slight	Ponderosa pine	77	Ponderosa pine.
Rock outcrop part.	-------	-------	-------	-------	-------	-------	-------	-------
Emdent:								
51	2w	Slight	Moderate	Slight	Severe	Black cottonwood	-------	Black cottonwood.
Havillah:								
59	3o	Slight	Slight	Slight	Severe	Ponderosa pine	90	Ponderosa pine, Douglas-fir.
						Douglas-fir	90	
60, 61	3o	Moderate	Slight	Slight	Severe	Ponderosa pine	90	Ponderosa pine, Douglas-fir.
						Douglas-fir	90	
63	4x	Severe	Moderate	Slight	Moderate	Ponderosa pine	80	Ponderosa pine, Douglas-fir.
						Douglas-fir	80	
Hodgson:								
64	3o	Slight	Slight	Slight	Severe	Douglas-fir	87	Douglas-fir, ponderosa pine.
						Ponderosa pine	87	
Hunters:								
66	2o	Slight	Slight	Slight	Severe	Ponderosa pine	110	Douglas-fir, ponderosa pine.
						Douglas-fir	110	
67, 68	2o	Moderate	Slight	Slight	Severe	Ponderosa pine	110	Douglas-fir, ponderosa pine.
						Douglas-fir	110	
69	2r	Severe	Moderate	Slight	Severe	Ponderosa pine	110	Douglas-fir, ponderosa pine.
						Douglas-fir	110	
Karamin:								
70	4o	Moderate	Slight	Slight	Severe	Douglas-fir	84	Douglas-fir, ponderosa pine.
						Ponderosa pine	82	
						Western larch	86	
						Lodgepole pine	70	

TABLE 4.—*Woodland management and productivity*—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Kartar:								
71, 72	4o	Moderate	Moderate	Moderate	Moderate	Ponderosa pine	74	Ponderosa pine, Douglas-fir.
						Douglas-fir	76	
73	4r	Moderate	Moderate	Moderate	Slight	Douglas-fir	76	Douglas-fir.
74	4x	Moderate	Moderate	Severe	Slight	Ponderosa pine	74	Ponderosa pine.
75	4x	Severe	Severe	Severe	Slight	Ponderosa pine	74	Ponderosa pine.
Koepke:								
76	3o	Slight	Slight	Slight	Moderate	Ponderosa pine	92	Ponderosa pine, Douglas-fir.
						Douglas-fir	98	
77, 78, 80	3o	Moderate	Slight	Slight	Moderate	Ponderosa pine	92	Ponderosa pine, Douglas-fir.
						Douglas-fir	98	
79	3r	Severe	Moderate	Slight	Moderate	Ponderosa pine	92	Ponderosa pine, Douglas-fir.
						Douglas-fir	98	
Leader:								
81	4o	Slight	Slight	Moderate	Moderate	Ponderosa pine	79	Ponderosa pine, Douglas-fir.
						Douglas-fir	76	
82	4o	Moderate	Slight	Moderate	Moderate	Ponderosa pine	79	Ponderosa pine, Douglas-fir.
						Douglas-fir	76	
83	4r	Severe	Moderate	Moderate	Moderate	Ponderosa pine	79	Ponderosa pine, Douglas-fir.
						Douglas-fir	76	
Leavenworth:								
84	2w	Slight	Slight	Slight	Severe	Ponderosa pine	103	Ponderosa pine, Douglas-fir.
						Douglas-fir	107	
Lithic Xerochrepts:								
[1]87:								
Lithic Xerochrepts part.								
Donavan part	4x	Severe	Severe	Severe	Slight	Ponderosa pine	77	Ponderosa pine.
Rock outcrop part.								
[1]89:								
Lithic Xerochrepts part.								
Kartar part	4x	Severe	Severe	Severe	Slight	Ponderosa pine	74	Ponderosa pine.
[1]90:								
Lithic Xerochrepts part.								
Molson part	3x	Severe	Severe	Slight	Moderate	Ponderosa pine	89	Douglas-fir, ponderosa pine.
						Douglas-fir	96	
[1]91:								
Lithic Xerochrepts part.								
Nevine part	4x	Severe	Severe	Moderate	Moderate	Douglas-fir	81	Ponderosa pine, Douglas-fir.
						Ponderosa pine	83	
[1]94:								
Lithic Xerochrepts part.								
Republic part	4x	Moderate	Moderate	Moderate	Moderate	Ponderosa pine	76	Ponderosa pine.
[1]95:								
Lithic Xerochrepts part.								
Vallan part	5d	Severe	Moderate	Severe	Slight	Ponderosa pine	63	Ponderosa pine.
						Douglas-fir	63	

TABLE 4.—*Woodland management and productivity*—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
[1]96: Lithic Xerochrepts part. Wadams part	4x	Severe	Severe	Severe	Slight	Douglas-fir Ponderosa pine	78 71	Ponderosa pine.
Merkel:								
98	4o	Slight	Slight	Moderate	Moderate	Douglas-fir Ponderosa pine Western larch	80 79 83	Douglas-fir, ponderosa pine.
99	4x	Moderate	Slight	Moderate	Moderate	Douglas-fir Ponderosa pine Western larch	80 79 83	Douglas-fir, ponderosa pine.
100	4x	Severe	Moderate	Moderate	Moderate	Douglas-fir Ponderosa pine Western larch	80 79 83	Douglas-fir, ponderosa pine.
Mires:								
101	4r	Severe	Severe	Moderate	Slight	Ponderosa pine	76	Ponderosa pine.
102	4x	Severe	Severe	Severe	Slight	Ponderosa pine	76	Ponderosa pine.
103	4o	Slight	Slight	Moderate	Slight	Ponderosa pine	76	Ponderosa pine.
104	4o	Moderate	Moderate	Moderate	Slight	Ponderosa pine	76	Ponderosa pine.
Molson:								
105	3o	Slight	Slight	Slight	Moderate	Ponderosa pine Douglas-fir	89 96	Douglas-fir, ponderosa pine.
106, 107, 109	3o	Moderate	Slight	Slight	Moderate	Ponderosa pine Douglas-fir	89 96	Douglas-fir, ponderosa pine.
Molson:								
108	3r	Severe	Moderate	Slight	Moderate	Ponderosa pine Douglas-fir	89 96	Douglas-fir, ponderosa pine.
110	3x	Moderate	Severe	Slight	Moderate	Ponderosa pine Douglas-fir	89 96	Douglas-fir, ponderosa pine.
111	3x	Severe	Severe	Slight	Moderate	Ponderosa pine Douglas-fir	89 96	Douglas-fir, ponderosa pine.
Nevine:								
118	3o	Moderate	Slight	Slight	Moderate	Douglas-fir Western larch Ponderosa pine	91 93 90	Douglas-fir.
119	3r	Severe	Moderate	Slight	Moderate	Douglas-fir Western larch Ponderosa pine	91 93 90	Douglas-fir.
120, 121	4x	Severe	Severe	Moderate	Moderate	Douglas-fir Ponderosa pine	81 83	Ponderosa pine, Douglas-fir.
Newbon:								
128	4r	Severe	Moderate	Slight	Moderate	Douglas-fir	70	Douglas-fir, ponderosa pine.
Owhi:								
139, 140	5o	Slight	Slight	Severe	Slight	Ponderosa pine	65	Ponderosa pine.
Republic:								
153, 154, 157, 158	3o	Moderate	Slight	Slight	Moderate	Ponderosa pine Douglas-fir	97 105	Douglas-fir, ponderosa pine.
155	4x	Moderate	Moderate	Moderate	Moderate	Ponderosa pine	76	Ponderosa pine.
156, 160	3o	Slight	Slight	Slight	Moderate	Ponderosa pine Douglas-fir	97 105	Douglas-fir, ponderosa pine.
159	3r	Severe	Moderate	Slight	Moderate	Ponderosa pine Douglas-fir	97 105	Douglas-fir, ponderosa pine.
Springdale:								
167, 168	5f	Slight	Slight	Severe	Slight	Ponderosa pine	69	Ponderosa pine.
169	5f	Moderate	Slight	Severe	Slight	Ponderosa pine	69	Ponderosa pine.
170	5x	Moderate	Slight	Severe	Slight	Ponderosa pine Douglas-fir	69 69	Ponderosa pine.
171	5x	Severe	Severe	Severe	Slight	Ponderosa pine Douglas-fir	69 69	Ponderosa pine.

TABLE 4.—*Woodland management and productivity*—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Wadams:								
179	4o	Slight	Slight	Moderate	Slight	Douglas-fir Ponderosa pine	78 71	Douglas-fir, ponderosa pine.
180	4x	Moderate	Moderate	Severe	Slight	Douglas-fir Ponderosa pine	78 71	Ponderosa pine.
181	4x	Severe	Severe	Severe	Slight	Douglas-fir Ponderosa pine	78 71	Ponderosa pine.
Winthrop:								
182	5s	Slight	Slight	Severe	Slight	Ponderosa pine	65	Ponderosa pine.
183	5x	Moderate	Moderate	Severe	Slight	Ponderosa pine	65	Ponderosa pine.
Xerofluvents:								
184	2w	Slight	Moderate	Slight	Moderate	Black cottonwood		Black cottonwood.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Engineering [6]

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings of this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipe-

[6] WILLIAM A. BENNETT, engineer, Soil Conservation Service, helped prepare this section.

TABLE 5.—*Recreational development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aeneas:				
1	Slight	Slight	Slight	Slight.
2	Slight	Slight	Moderate: slope	Slight.
3	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Badland:				
4				
Boesel:				
5	Moderate: wetness	Slight	Moderate: wetness	Slight.
Boesel Variant:				
6	Moderate: dusty, percs slowly.	Moderate: dusty	Moderate: dusty, percs slowly.	Moderate: dusty.
Cashmere:				
7	Slight	Slight	Slight	Slight.
8	Slight	Slight	Moderate: slope	Slight.
9	Moderate: slope	Moderate: slope	Severe: slope	Slight.
10	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
11	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Cashmont:				
12	Slight	Slight	Slight	Slight.
13	Slight	Slight	Moderate: slope	Slight.
14	Moderate: slope	Moderate: slope	Severe: slope	Slight.
15	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
16	Moderate: small stones.	Moderate: small stones.	Severe: small stones	Moderate: small stones.
17	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
18	Severe: small stones	Severe: small stones	Severe: slope, small stones.	Severe: small stones.
19	Severe: large stones	Moderate: small stones, large stones, slope.	Severe: small stones, large stones, slope.	Severe: large stones.
Cashmont:				
20	Severe: large stones, slope.	Severe: slope	Severe: small stones, large stones, slope.	Severe: large stones, slope.
Chesaw:				
21	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
22	Severe: large stones, slope.	Severe: slope	Severe: slope, small stones, large stones.	Severe: large stones.
Colville:				
23, 24	Moderate: wetness, percs slowly.	Moderate: wetness	Moderate: wetness, percs slowly.	Moderate: wetness.
Conconully:				
25	Moderate: small stones.	Moderate: small stones.	Severe: small stones	Moderate: small stones.
26	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, small stones.
27	Slight	Slight	Moderate: slope, small stones.	Slight.
28	Moderate: slope	Moderate: slope	Severe: slope	Slight.
29	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
30	Severe: large stones	Moderate: slope, large stones.	Severe: slope, large stones, small stones.	Severe: large stones.
31, 32	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones, small stones.	Severe: large stones, slope.
Dinkelman:				
33	Moderate: slope	Moderate: slope	Severe: slope	Slight.
34, 38	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
35	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope	Moderate: small stones.
36	Severe: large stones	Severe: large stones	Severe: slope, large stones.	Severe: large stones.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
37	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Disautel:				
39	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
40	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope	Moderate: dusty.
41	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
42	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
43	Severe: large stones	Moderate: slope, large stones, dusty.	Severe: slope, large stones.	Severe: large stones.
44	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
Donavan:				
45	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
46	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
47	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
48	Severe: large stones	Moderate: small stones, large stones, slope.	Severe: slope, large stones, small stones.	Severe: large stones.
49	Severe: large stones, slope.	Severe: slope	Severe: slope, large stones, small stones.	Severe: large stones, slope.
[1] 50:				
Donavan part	Severe: large stones, slope.	Severe: slope	Severe: slope, large stones, small stones.	Severe: large stones, slope.
Rock outcrop part				
Emdent:				
51	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Ewall:				
52, 53	Severe: soil blowing	Severe: soil blowing	Severe: slope, soil blowing.	Severe: soil blowing.
54	Severe: slope, soil blowing.	Severe: slope, soil blowing.	Severe: slope, soil blowing.	Severe: soil blowing.
Ewall:				
55	Severe: slope, soil blowing.	Severe: slope, soil blowing.	Severe: slope, soil blowing.	Severe: slope, soil blowing.
Haley:				
56	Slight	Slight	Moderate: slope	Slight.
57	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
58	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Havillah:				
59	Severe: dusty	Severe: dusty	Severe: dusty	Severe: dusty.
60	Severe: dusty	Severe: dusty	Severe: slope, dusty	Severe: dusty.
61	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: dusty.
62	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty.
63	Severe: slope, large stones, dusty.	Severe: slope, dusty, large stones.	Severe: slope, dusty, large stones.	Severe: slope, large stones, dusty.
Hodgson:				
64	Moderate: slope, percs slowly, dusty.	Moderate: slope, dusty.	Severe: slope	Moderate: dusty.
Hum:				
65	Severe: dusty	Severe: dusty	Severe: dusty, slope	Severe: dusty.
Hunters:				
66	Moderate: percs slowly, dusty.	Moderate: dusty	Moderate: slope, percs slowly, dusty.	Moderate: dusty.
67	Moderate: slope, percs slowly, dusty.	Moderate: slope, dusty.	Severe: slope	Moderate: dusty.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
68	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
69	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Karamin:				
70	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Kartar:				
71	Moderate: slope	Moderate: slope	Severe: slope	Slight.
72	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
73	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
74	Severe: large stones	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
75	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
Koepke:				
76	Severe: dusty	Severe: dusty	Severe: dusty	Severe: dusty.
77, 80	Severe: dusty	Severe: dusty	Severe: slope, dusty	Severe: dusty.
78	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: dusty.
79	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty.
Leader:				
81	Slight	Slight	Moderate: slope	Slight.
82	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
83	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Leavenworth:				
84	Moderate: wetness	Slight	Moderate: floods, wetness, slope.	Slight.
Lithic Xerochrepts:				
[1]85:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Cashmont part	Severe: large stones, slope.	Severe: slope	Severe: small stones, large stones, slope.	Severe: large stones, slope.
[1]86:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
[1]86:				
Conconully part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones, small stones.	Severe: large stones.
[1]87:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Donavan part	Severe: large stones, slope.	Severe: slope	Severe: slope, large stones, small stones.	Severe: large stones, slope.
Rock outcrop part				
[1]88:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: large stones, small stones.
Hum part	Severe: dusty	Severe: dusty	Severe: dusty, slope	Severe: dusty.
[1]89:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Kartar part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
[1]90:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Molson part	Severe: slope, dusty, large stones.	Severe: slope, dusty	Severe: slope, large stones, small stones.	Severe: slope, dusty, large stones.
[1]91:				
Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Nevine part	Severe: dusty, large stones, slope.	Severe: slope, dusty	Severe: slope, small stones, large stones.	Severe: slope, dusty, large stones.
[1]92: Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Newbon part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
[1]93: Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Nighthawk part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
[1]94: Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Republic part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
[1]95: Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Vallan part	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
[1]96: Lithic Xerochrepts part	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: slope, depth to rock.	Severe: slope, large stones, small stones.
Wadams part	Severe: slope, large stones.	Severe: slope	Severe: large stones, small stones, slope.	Severe: slope, large stones.
Marsh: 97				
Merkel: 98	Moderate: slope	Moderate: slope	Severe: slope	Slight.
99	Severe: large stones	Moderate: slope, large stones.	Severe: small stones, large stones, slope.	Severe: large stones.
Merkel: 100	Severe: large stones, slope.	Severe: slope	Severe: small stones, large stones, slope.	Severe: large stones, slope.
Mires: 101	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty.
102	Severe: slope, large stones, dusty.	Severe: slope, dusty	Severe: slope, large stones, dusty.	Severe: slope, large stones, dusty.
103	Severe: dusty	Severe: dusty	Severe: dusty	Severe: dusty.
104	Severe: dusty	Severe: dusty	Severe: slope, dusty	Severe: dusty.
Molson: 105, 106	Severe: dusty	Severe: dusty	Severe: dusty	Severe: dusty.
107	Severe: slope, dusty	Severe: slope, dusty	Severe: dusty	Severe: dusty.
108	Severe: slope, dusty	Severe: slope, dusty	Severe: dusty	Severe: slope, dusty.
109	Severe: dusty	Severe: dusty	Severe: slope, dusty, small stones.	Severe: dusty.
110	Severe: large stones, dusty, slope.	Severe: slope, dusty	Severe: slope, large stones, small stones.	Severe: dusty, large stones.
111	Severe: large stones, dusty, slope.	Severe: slope, dusty	Severe: slope, large stones, small stones.	Severe: slope, dusty, large stones.
Nespelem: 112	Moderate: dusty, percs slowly.	Moderate: dusty	Moderate: slope, dusty, percs slowly.	Moderate: dusty.
113	Moderate: slope, dusty, percs slowly.	Moderate: slope, dusty.	Severe: slope	Moderate: dusty.
114, 115	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
116	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Nespelem: 117	Moderate: percs slowly, dusty.	Moderate: dusty	Moderate: percs slowly, dusty.	Moderate: dusty.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Nevine:				
118	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: dusty.
119	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty	Severe: slope, dusty.
120	Severe: dusty, large stones.	Severe: dusty	Severe: slope, small stones, large stones.	Severe: dusty, large stones.
121	Severe: dusty, large stones, slope.	Severe: slope, dusty	Severe: slope, small stones, large stones.	Severe: slope, dusty, large stones.
Newbon:				
122	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty, small stones.	Moderate: dusty.
123	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope	Moderate: dusty.
124	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
125	Moderate: small stones.	Moderate: small stones.	Severe: small stones	Moderate: small stones.
126	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
127, 128, 129	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
130	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: large stones.
Nighthawk:				
131	Slight	Slight	Moderate: slope, small stones.	Slight.
132	Moderate: slope	Moderate: slope	Severe: slope	Slight.
133	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
134	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: large stones.
135, 136	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
Okanogan:				
137, 138	Moderate: dusty	Modreate: dusty	Moderate: dusty	Moderate: dusty.
Owhi:				
139	Slight	Slight	Slight	Slight.
140	Slight	Slight	Moderate: slope	Slight.
141	Moderate: small stones.	Moderate: small stones.	Severe: small stones	Moderate: small stones.
142	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, small stones.
143	Severe: large stones	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
Owhi:				
144	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
Pogue:				
145	Slight	Slight	Slight	Slight.
146	Slight	Slight	Moderate: slope	Slight.
147	Moderate: slope	Moderate: slope	Severe: slope	Slight.
148	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
149	Moderate: small stones.	Moderate: small stones.	Severe: small stones	Moderate: small stones.
150	Severe: slope	Severe: slope	Severe: small stones, slope.	Moderate: slope, small stones.
151	Severe: large stones	Moderate: slope, large stones.	Severe: large stones, slope.	Severe: large stones.
152	Severe: large stones, slope.	Severe: slope	Severe: large stones, slope.	Severe: large stones, slope.
Republic:				
153, 157	Moderate: slope	Moderate: slope	Severe: slope	Slight.
154, 158	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
155	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
156, 160	Slight	Slight	Moderate: slope	Slight.
159	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Riverwash:				
161				
Rock outcrop:				
162				
Skaha:				
163	Moderate: too sandy	Moderate: too sandy	Moderate: slope, too sandy.	Moderate: too sandy.
164	Moderate: small stones, too sandy.	Moderate: small stones too sandy.	Severe: small stones, slope.	Moderate: small stones, too sandy.
165	Severe: slope	Severe: slope	Severe: small stones, slope.	Moderate: slope, small stones, too sandy.
Skaha:				
166	Severe: slope	Severe: slope	Severe: small stones, slope.	Severe: slope.
Springdale:				
167	Slight	Slight	Moderate: small stones.	Slight.
168	Slight	Slight	Moderate: slope, small stones.	Slight.
169	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
170	Severe: large stones	Severe: large stones	Severe: slope, large stones.	Severe: large stones.
171	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Synarep:				
172	Severe: dusty	Severe: dusty	Severe: dusty	Severe: dusty.
Tonasket:				
173	Moderate: dusty, percs slowly.	Moderate: dusty	Moderate: dusty, percs slowly.	Moderate: dusty.
174	Moderate: dusty, percs slowly.	Moderate: dusty	Moderate: slope, dusty, percs slowly.	Moderate: dusty.
175	Moderate: slope, dusty, percs slowly.	Moderate: slope, dusty	Severe: slope	Moderate: dusty.
176	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
177	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
178	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
Wadams:				
179	Moderate: slope	Moderate: slope	Severe: slope	Slight.
180	Severe: large stones	Moderate: slope, large stones.	Severe: large stones, small stones, slope.	Severe: large stones.
181	Severe: slope, large stones.	Severe: slope	Severe: large stones, small stones, slope.	Severe: slope, large stones.
Winthrop:				
182	Moderate: too sandy, small stones.	Moderate: too sandy, small stones.	Severe: small stones, slope.	Moderate: too sandy.
183	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones, small stones.	Severe: large stones.
Xerofluvents:				
184	Severe: floods	Severe: floods	Severe: floods, slope	Severe: floods.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

lines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 6 shows, for each kind of soil, the degree and kind of limitations for building site development; table 7, for sanitary facilities; and table 8, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 6. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 6 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 6 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soils as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 7 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*,

TABLE 6.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aeneas:					
1	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
2	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Moderate: frost action.
3	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
Badland:					
4					
Boesel:					
5	Severe: floods, cutbanks cave, wetness.	Severe: floods	Severe: floods, wetness.	Severe: floods	Moderate: floods, frost action.
Boesel Variant:					
6	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: low strength.
Cashmere:					
7	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
8	Slight	Slight	Slight	Moderate: slope	Moderate: low strength, frost action.
9	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: low strength, frost action, slope.
10, 11	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Cashmont:					
12	Moderate: small stones.	Slight	Slight	Slight	Moderate: frost action.
13, 16	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
14, 17, 18	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
15	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
19	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Moderate: large stones, frost action, slope.
20	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Chesaw:					
21	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
22	Severe: large stones, small stones, slope.	Severe: large stones.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Colville:					
23	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, low strength.
24	Severe: floods, wetness.	Severe: floods	Severe: floods, wetness.	Severe: floods	Severe: floods, frost action, low strength.
Conconully:					
25, 27	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
26, 29	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
28	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
30	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: large stones, frost action, slope.
31, 32	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Dinkelman:					
33, 35	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: frost action, low strength, slope.
34, 38	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
36	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
37	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
Disautel:					
39	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
40	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
41, 42	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Disautel:					
43	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: slope, large stones, frost action.
44	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Donavan:					
45	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: frost action, low strength.
46, 47	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
48	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Moderate: large stones, frost action.
49	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
[1]50:					
Donavan part	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Rock outcrop part					
Emdent:					
51	Severe: floods, wetness.	Severe: floods	Severe: floods, wetness.	Severe: floods	Severe: floods, frost action.
Ewall:					
52, 53	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
54, 55	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Haley:					
56	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Moderate: frost action.
57, 58	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Havillah:					
59	Moderate: small stones.	Slight	Slight	Moderate: slope	Severe: frost action.
60	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Severe: frost action.
61, 62	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
63	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, frost action.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hodgson:					
64	Moderate: slope	Moderate: slope, shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: slope	Moderate: slope, frost action, low strength.
Hum:					
65	Moderate: slope, too clayey, small stones.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope	Severe: low strength, frost action.
Hunters:					
66	Severe: too clayey.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Moderate: low strength, slope.	Severe: frost action.
67	Severe: too clayey.	Moderate: low strength, slope.	Moderate: slope, low strength, shrink-swell.	Severe: slope	Severe: frost action.
68, 69	Severe: slope, too clayey.	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
Karamin:					
70	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Kartar:					
71	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
72	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
73, 75	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
74	Severe: large stones, small stones, cutbanks cave.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: slope, frost action, large stones.
Koepke:					
76	Moderate: small stones.	Slight	Slight	Moderate: slope	Severe: frost action.
77, 80	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Severe: frost action.
78, 79	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
Leader:					
81	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Moderate: frost action.
82, 83	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Leavenworth:					
84	Severe: floods, wetness.	Severe: floods	Severe: floods, wetness.	Severe: floods	Severe: floods.
Lithic Xerochrepts:					
[1]85:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Cashmont part	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
[1]86:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Conconully part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
[1]87:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Donavan part	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Rock outcrop part					
[1]88:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Hum part	Moderate: slope, too clayey, small stones.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope	Severe: low strength, frost action.
[1]89:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Kartar part	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
[1]90:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Molson part	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: frost action, large stones, slope.
[1]91:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Nevine part	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.
[1]92:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Newbon part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
[1]93:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Nighthawk part	Severe: slope, large stones, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
[1]94:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Republic part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
[1]95:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Vallan part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
[1]96:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Wadams part	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, frost action.
Marsh:					
97					
Merkel:					
98	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
99	Severe: large stones, cutbanks cave.	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Moderate: slope, large stones.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
100	Severe: large stones, slope, cutbanks cave.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Mires:					
101	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
102	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
103	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Severe: frost action.
104	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Severe: frost action.
Molson:					
105	Moderate: small stones.	Slight	Slight	Moderate: slope	Severe: frost action.
106, 109	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Severe: frost action.
107, 108	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
110, 111	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: frost action, large stones, slope.
Nespelem:					
112	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Severe: frost action.
113	Moderate: slope	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope	Severe: frost action.
Nespelem:					
114, 115, 116	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
117	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Severe: frost action.
Nevine:					
118, 119	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
120	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Severe: large stones.
121	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.
Newbon:					
122, 125	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
123	Moderate: slope, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
124, 126, 127, 128, 129	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
130	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Nighthawk:					
131	Severe: small stones, cutbanks cave.	Slight	Slight	Moderate: slope	Moderate: frost action.
132	Severe: small stones, cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
133	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
134, 135, 136	Severe: slope, large stones, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Okanogan:					
137, 138	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Owhi:					
139	Severe: cutbanks cave, small stones.	Slight	Slight	Slight	Moderate: frost action.
140, 141	Severe: cutbanks cave, small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
Owhi:					
142	Severe: slope, cutbanks cave, small stones.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
143	Severe: large stones, cutbanks cave.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: slope, frost action, large stones.
144	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Pogue:					
145	Severe: cutbanks cave, small stones.	Slight	Slight	Slight	Moderate: frost action.
146, 149	Severe: cutbanks cave, small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
147	Severe: cutbanks cave, small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: frost action, slope.
148, 150	Severe: slope, cutbanks cave, small stones.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
151	Severe: large stones, cutbanks cave, small stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Moderate: slope, frost action, large stones.
152	Severe: slope, small stones, cutbanks cave.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Republic:					
153, 157	Moderate: small stones, slope.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action.
154, 158, 159	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
155	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
156	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: frost action.
160	Severe: cutbanks cave, small stones.	Slight	Slight	Slight	Moderate: frost action.
Riverwash:					
161	---	---	---	---	---
Rock outcrop:					
162	---	---	---	---	---
Skaha:					
163, 164	Severe: cutbanks cave, small stones.	Slight	Slight	Moderate: slope	Slight.
165, 166	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Springdale:					
167	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
168	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
169	Severe: slope, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
170	Severe: large stones, cutbanks cave.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: slope, large stones.
171	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Synarep:					
172	Moderate: wetness, floods.	Severe: floods	Severe: floods	Severe: floods	Severe: frost action.
Tonasket:					
173	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: frost action, low strength.
174	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: frost action, low strength.
175	Moderate: slope	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope	Moderate: slope, frost action, low strength.
176, 177	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
178	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Wadams:					
179	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: frost action, slope.
180	Severe: large stones, cutbanks cave, small stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: frost action, slope, large stones.
181	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Winthrop:					
182	Severe: cutbanks cave, small stones.	Slight	Slight	Moderate: slope	Slight.
183	Severe: slope, large stones, cutbanks cave.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Xerofluvents:					
184	Severe: floods	Severe: floods	Severe: floods, wetness.	Severe: floods	Poor: floods.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe,* soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good, fair,* or *poor,* which, respectively, mean about the same as the terms *slight, moderate,* and *severe.*

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the

TABLE 7.—*Sanitary facilities*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aeneas:					
1, 2	Slight [2]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: thin layer, area reclaim.
3	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: thin layer, area reclaim, slope.
Badland:					
4					
Boesel:					
5	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: thin layer, area reclaim, wetness.
Boesel Variant:					
6	Severe: floods, percs slowly.	Severe: floods	Severe: floods	Severe: floods	Fair: too clayey.
Cashmere:					
7, 8	Slight [2]	Severe: seepage	Severe: seepage	Slight	Good.
9	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage	Moderate: slope	Fair: slope.
10	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope	Poor: slope.
11	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope	Poor: slope.
Cashmont:					
12, 13, 16	Slight [2]	Severe: seepage, small stones.	Severe: seepage	Severe: seepage	Poor: small stones.
14, 17, 18	Moderate: [2] slope.	Severe: slope, seepage, small stones.	Severe: seepage	Severe: seepage	Poor: small stones.
15	Severe: slope	Severe: slope, seepage, small stones.	Severe: seepage	Severe: slope, seepage.	Poor: slope, small stones.
19	Severe: large stones.	Severe: large stones, seepage, slope.	Severe: seepage, large stones.	Severe: seepage	Poor: large stones, small stones.
20	Severe: large stones, seepage, slope.	Severe: large stones, seepage, slope.	Severe: slope, large stones, seepage.	Severe: slope, seepage.	Poor: large stones, small stones, slope.
Chesaw:					
21	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: too sandy, small stones, slope.
22	Severe: large stones, slope.	Severe: seepage, large stones, slope.	Severe: slope, large stones, seepage.	Severe: slope	Poor: slope, large stones, small stones.
Colville:					
23, 24	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: too clayey.
Conconully:					
25, 27	Slight [2]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: small stones.
26, 29	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
28	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: slope, small stones.
30	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones.	Severe: seepage	Poor: large stones.
31, 32	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones, slope.	Severe: slope, seepage.	Poor: slope, large stones.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Dinkelman:					
33, 35	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: slope, small stones.
34, 38	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
36	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: large stones, seepage.	Severe: seepage	Poor: large stones.
37	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, large stones, seepage.	Severe: slope, seepage.	Poor: slope, large stones.
Disautel:					
39	Slight	Moderate: slope, seepage.	Moderate: small stones.	Slight	Good.
40	Moderate: slope	Severe: slope	Moderate: small stones.	Moderate: slope	Fair: slope.
41	Severe: slope	Severe: slope	Moderate: slope, small stones.	Severe: slope	Poor: slope.
Disautel:					
42	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
43	Severe: large stones.	Severe: slope, large stones, seepage.	Severe: large stones.	Moderate: slope	Poor: large stones.
44	Severe: slope, large stones.	Severe: slope, large stones, seepage.	Severe: slope, large stones.	Severe: slope	Poor: slope, large stones.
Donavan:					
45	Slight	Moderate: slope, seepage, small stones.	Slight	Slight	Fair: small stones.
46	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
47	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
48	Severe: large stones.	Severe: large stones, slope.	Severe: large stones.	Severe: slope	Poor: large stones, small stones.
49	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope	Poor: slope, large stones, small stones.
[1] 50:					
Donavan part	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope	Poor: slope, large stones, small stones.
Rock outcrop part					
Emdent:					
51	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Ewall:					
52, 53	Slight [3]	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Poor: too sandy.
54	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: too sandy, slope.
55	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: too sandy, slope.
Haley:					
56	Slight [3]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: area reclaim, thin layer.
57	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
Haley:					
58	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope seepage.	Poor: slope.
Havillah:					
59	Severe: percs slowly.	Moderate: slope	Slight	Slight	Fair: small stones.
60	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope, small stones.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
61	Severe: slope, percs slowly.	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
62	Severe: slope, percs slowly.	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
63	Severe: slope, large stones, percs slowly.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope	Poor: slope, large stones.
Hodgson:					
64	Severe: percs slowly.	Severe: slope	Moderate: too clayey.	Moderate: slope	Fair: slope, too clayey.
Hum:					
65	Severe: percs slowly.	Severe: slope	Moderate: too clayey.	Moderate: slope	Fair: small stones, too clayey, slope.
Hunters:					
66	Severe: percs slowly.	Moderate: slope, seepage.	Severe: too clayey.	Slight	Poor: too clayey.
67	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Moderate: slope	Poor: too clayey.
68	Severe: slope, percs slowly.	Severe: slope	Severe: too clayey.	Severe: slope	Poor: slope, too clayey.
69	Severe: slope, percs slowly.	Severe: slope	Severe: slope, too clayey.	Severe: slope	Poor: slope, too clayey.
Karamin:					
70	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: too sandy, area reclaim, slope.
Kartar:					
71	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: slope, small stones, area reclaim.
72	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
Kartar:					
73	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
74	Severe: large stones.	Severe: slope, seepage.	Severe: seepage, large stones.	Severe: seepage	Poor: large stones.
75	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
Koepke:					
76	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Poor: area reclaim.
77, 80	Moderate: slope	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Poor: area reclaim.
78	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope, area reclaim.
79	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, area reclaim.
Leader:					
81	Slight [2]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: area reclaim, thin layer.
82	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
83	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
Leavenworth:					
84	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Good.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lithic Xerochrepts:					
[1]85:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Cashmont part	Severe: large stones, slope.	Severe: large stones, seepage, slope.	Severe: slope, large stones, seepage.	Severe: slope, seepage.	Poor: large stones, small stones, slope.
[1]86:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
[1]86:					
Conconully part	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones, slope.	Severe: slope, seepage.	Poor: slope, large stones.
[1]87:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Donavan part	Severe: large stones.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope	Poor: slope, large stones, small stones.
Rock outcrop part					
[1]88:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Hum part	Severe: percs slowly.	Severe: slope	Moderate: too clayey.	Moderate: slope	Fair: small stones, too clayey, slope.
[1]89:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer area reclaim.
Kartar part	Severe: slope, large stones.	Severe: slope, seepage.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
[1]90:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Molson part	Severe: large, stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope	Poor: large stones, slope.
[1]91:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Nevine part	Severe: large stones, slope.	Severe: seepage, large stones, slope.	Severe: large stones, seepage, slope.	Severe: slope, seepage.	Poor: small stones, large stones, slope.
[1]92:					
Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Newbon part	Severe: slope, large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: slope	Poor: slope, large stones.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
[1]93: Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Nighthawk part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope	Poor: slope, small stones, large stones.
[1]94: Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Republic part	Severe: slope, large stones.	Severe: slope, seepage.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
[1]95: Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Vallan part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: area reclaim, slope, thin layer.
[1]96: Lithic Xerochrepts part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
Wadams part	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones, slope.	Severe: slope, seepage.	Poor: large stones, seepage, slope.
Marsh: 97					
Merkel: 98	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: small stones.
99	Severe: large stones.	Severe: seepage, large stones, slope.	Severe: seepage, large stones.	Severe: seepage	Poor: large stones.
100	Severe: large stones, slope.	Severe: seepage, large stones, slope.	Severe: seepage, large stones, slope.	Severe: slope, seepage.	Poor: large stones, slope.
Mires: 101	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: slope.
102	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
103	Slight [2]	Severe: seepage	Severe: seepage, too sandy.	Severe: seepage	Fair: small stones, seepage.
104	Moderate: [2] slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage	Fair: small stones, seepage, slope.
Molson: 105	Slight	Moderate: slope, seepage, small stones.	Slight	Slight	Fair: small stones.
106, 109	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope, small stones.
107	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
108	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
110	Severe: large stones, slope.	Severe: slope, large stones.	Severe: large stones.	Severe: slope	Poor: large stones, slope.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
111	Severe: large stones, slope.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope	Poor: large stones, slope.
Nespelem:					
112	Severe: percs slowly.	Moderate: slope	Slight	Slight	Good.
113	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
114, 115	Severe: slope, percs slowly.	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Nespelem:					
116	Severe: slope, percs slowly.	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
117	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Nevine:					
118	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
119	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
120	Severe: large stones.	Severe: seepage, large stones, slope.	Severe: seepage, large stones.	Severe: seepage	Poor: small stones, large stones.
121	Severe: large stones, slope.	Severe: seepage, large stones, slope.	Severe: large stones, seepage, slope.	Severe: slope, seepage.	Poor: small stones, large stones, slope.
Newbon:					
122, 125	Slight	Moderate: slope, seepage.	Slight	Slight	Fair: small stones.
123	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope, small stones.
124, 126	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
127, 128	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
129	Severe: slope	Severe: small stones, slope.	Severe: slope	Severe: slope	Poor: slope.
130	Severe: slope, large stones.	Severe: large stones.	Severe: large stones.	Severe: slope	Poor: slope, large stones.
Nighthawk:					
131	Slight	Moderate: slope, seepage.	Moderate: small stones.	Slight	Poor: small stones.
132	Moderate: slope	Severe: slope	Moderate: small stones.	Moderate: slope	Poor: small stones.
133	Severe: slope	Severe: slope	Moderate: slope, small stones.	Severe: slope	Poor: slope, small stones.
134	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: slope	Poor: slope, small stones, large stones.
135, 136	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope	Poor: slope, small stones, large stones.
Okanogan:					
137	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Good.
138	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Fair: thin layer, area reclaim.
Owhi:					
139, 140, 141	Slight[2]	Severe: seepage	Severe: seepage, small stones, too sandy.	Severe: seepage	Poor: area reclaim.
142	Severe: slope	Severe: slope, seepage.	Severe: seepage, small stones, too sandy.	Severe: slope, seepage.	Poor: area reclaim, slope.
143	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones, too sandy.	Severe: seepage	Poor: large stones, area reclaim.
144	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: large stones, slope, too sandy.	Severe: slope, seepage.	Poor: slope, large stones, area reclaim.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pogue:					
145, 146, 149	Slight [3]	Severe: seepage, small stones.	Severe: seepage, small stones, too sandy.	Severe: seepage	Severe: too sandy, small stones, area reclaim.
147	Moderate: [2] slope.	Severe: slope, seepage, small stones.	Severe: seepage, small stones, too sandy.	Severe: seepage	Severe: too sandy, small stones, area reclaim.
148, 150	Severe: slope	Severe: slope, seepage, small stones.	Severe: seepage, small stones, too sandy.	Severe: slope, seepage.	Severe: too sandy, small stones, slope.
151	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, too sandy, large stones.	Severe: seepage	Severe: large stones, small stones, too sandy.
152	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: seepage, too sandy, slope.	Severe: slope, seepage.	Severe: small stones, too sandy, slope.
Republic:					
153, 157	Moderate: [3] slope.	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: small stones, slope.
154, 158	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
155	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, large stones.
156	Slight [3]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: small stones.
Republic:					
159	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
160	Slight [3]	Severe: seepage, small stones.	Severe: seepage, small stones, too sandy.	Severe: seepage	Fair: thin layer, small stones, area reclaim.
Riverwash:					
161	---	---	---	---	---
Rock outcrop:					
162	---	---	---	---	---
Skaha:					
163, 164	Slight [3]	Severe: seepage, small stones.	Severe: seepage, too sandy, small stones.	Severe: seepage	Fair: small stones, too sandy, area reclaim.
165	Severe: slope	Severe: small stones, seepage, slope.	Severe: seepage, too sandy, small stones.	Severe: slope, seepage.	Poor: slope.
166	Severe: slope	Severe: small stones, seepage, slope.	Severe: slope, seepage, small stones.	Severe: slope, seepage.	Poor: slope.
Springdale:					
167, 168	Slight [3]	Severe: seepage, small stones.	Severe: too sandy, seepage, small stones.	Severe: seepage	Poor: too sandy, small stones.
169	Severe: slope	Severe: small stones, seepage, slope.	Severe: too sandy, seepage, small stones.	Severe: slope, seepage.	Poor: too sandy, small stones, slope.
170	Severe: large stones.	Severe: seepage, small stones, slope.	Severe: seepage, too sandy, large stones.	Severe: seepage	Poor: large stones, small stones, too sandy.
171	Severe: slope, large stones.	Severe: seepage, small stones, slope.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: small stones, too sandy, slope.
Synarep:					
172	Severe: wetness	Severe: wetness, seepage, floods.	Severe: wetness, seepage.	Severe: wetness, seepage.	Good.
Tonasket:					
173	Severe: percs slowly.	Slight	Slight	Slight	Good.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
174	Severe: percs slowly.	Moderate: slope	Slight	Slight	Good.
175	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
Tonasket:					
176	Severe: slope, percs slowly.	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
177	Severe: slope, percs slowly.	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
178	Severe: percs slowly, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope	Poor: slope, large stones.
Wadams:					
179	Moderate: slope	Severe: slope, seepage, small stones.	Severe: seepage, small stones.	Severe: seepage	Poor: seepage, small stones, area reclaim.
180	Severe: large stones.	Severe: slope, seepage, large stones.	Severe: seepage, small stones, large stones.	Severe: seepage	Poor: large stones, small stones, seepage.
181	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: seepage, large stones, slope.	Severe: slope, seepage.	Poor: large stones, seepage, slope.
Winthrop:					
182	Slight	Severe: slope, seepage, small stones.	Severe: too sandy, seepage, small stones.	Severe: seepage	Severe: too sandy, seepage, small stones.
183	Severe: slope, large stones.	Severe: seepage, large stones, slope.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: large stones, seepage, slope.
Xerofluvents:					
184	Severe: floods	Severe: slope, floods.	Severe: floods	Severe: floods	Good.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.
[2] Excessive permeability rate may cause pollution of groundwater.

effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

TABLE 8.—*Water management*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
Aeneas:						
1	Seepage	Piping, seepage.	Deep to water	Cutbanks cave	Seepage, droughty.	Piping.
2	Seepage	Piping, seepage.	Deep to water	Slope, cutbanks cave.	Slope, seepage, droughty.	Piping.
3	Slope	Piping, seepage.	Deep to water	Slope, cutbanks cave.	Slope, seepage, droughty.	Slope, piping.
Badland:						
4						
Boesel:						
5	Seepage	Piping, seepage.	Deep to water	Cutbanks cave, floods, wetness.	Droughty, wetness, floods.	Piping.
Boesel Variant:						
6	Favorable	Low strength, piping.	Deep to water	Floods	Floods	Favorable.
Cashmere:						
7	Seepage	Piping, low strength.	No water	Slope	Droughty	Piping.
8	Seepage	Piping, low strength.	No water		Slope, droughty.	Piping.
9, 10, 11	Slope, seepage	Piping, low strength.	No water		Slope, droughty.	Slope, piping.
Cashmont:						
12	Seepage	Seepage, piping.	No water	Favorable	Droughty	Piping.
13, 16	Seepage	Seepage, piping.	No water	Slope	Droughty, slope.	Piping.
14, 15, 17, 18	Slope, seepage	Seepage, piping.	No water	Slope	Droughty, slope.	Slope, piping.
19, 20	Slope, seepage	Piping, large stones.	No water			Slope, large stones.
Chesaw:						
21	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, droughty, fast intake.	Slope, droughty.
22	Slope, seepage	Seepage, large stones.	No water			Complex slope, large stones, droughty.
Colville:						
23	Favorable	Piping, low strength, hard to pack.	Favorable	Floods, poor outlets, wetness.	Floods, wetness.	Piping, poor outlets, wetness.
24	Favorable	Piping, low strength.	Favorable	Floods, poor outlets, wetness.	Floods, wetness.	Piping, poor outlets, wetness.
Conconully:						
25, 27	Seepage	Piping	No water	Slope	Slope, droughty.	Piping.
26, 28, 29	Slope, seepage	Piping	No water	Slope	Slope, droughty.	Slope, piping.
30, 31, 32	Slope, seepage	Piping, large stones.	No water			Slope, piping, large stones.
Dinkelman:						
33, 34, 35, 38	Slope, seepage	Piping	No water	Slope	Slope, droughty.	Slope, piping.
36, 37	Slope, seepage	Piping, large stones.	No water			Slope, piping, large stones.
Disautel:						
39	Seepage	Piping, low strength, hard to pack.	No water	Slope	Slope, erodes easily.	Erodes easily.

TABLE 8.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
40, 41, 42	Slope, seepage	Piping, low strength, hard to pack.	No water	Slope	Slopes, erodes easily.	Slope, erodes easily.
43, 44	Slope	Large stones, piping, low strength.	No water			Large stones, slope, erodes easily.
Donavan:						
45	Favorable	Piping	No water	Slope, frost action.	Slope, erodes easily.	Piping, erodes easily.
46, 47	Slope	Piping	No water	Slope, frost action.	Slope, erodes easily.	Slope, piping, erodes easily.
48, 49	Slope, seepage	Large stones, piping.	No water			Slope, large stones.
[1] 50:						
Donavan part	Slope, seepage	Large stones, piping.	No water			Slope, large stones.
Rock outcrop part						
Emdent:						
51	Favorable	Piping, low strength, hard to pack.	Favorable	Floods, poor outlets.	Floods, wetness.	Piping, poor outlets, wetness.
Ewall:						
52, 53	Seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, soil blowing.	Too sandy, droughty, soil blowing.
54, 55	Slope, seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.
Haley:						
56	Seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, seepage, droughty.	Piping, erodes easily.
57, 58	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, seepage, droughty.	Slope, piping, erodes easily.
Havillah:						
59	Favorable	Piping, erodes easily, low strength.	No water	Slope, percs slowly.	Slope, erodes easily.	Piping, percs slowly.
60, 61, 62	Slope	Piping, erodes easily, low strength.	No water	Slope, percs slowly.	Slope, erodes easily.	Slope, piping, percs slowly.
63	Slope	Large stones, piping, low strength.	No water			Slope, large stones, percs slowly.
Hodgson:						
64	Slope	Piping, low strength, hard to pack.	Deep to water, percs slowly.	Slope, percs slowly.	Slope, erodes easily.	Slope, piping, erodes easily.
Hum:						
65	Slope	Shrink-swell, low strength, piping.	No water	Slope	Slope	Slope, piping.
Hunters:						
66	Seepage	Low strength, piping.	No water	Slope, frost action, percs slowly.	Slope, erodes easily.	Piping, percs slowly, erodes easily.
67, 68, 69	Slope, seepage	Low strength, piping.	No water	Slope, frost action, percs slowly.	Slope, erodes easily.	Slope, piping, erodes easily.
Karamin:						
70	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, droughty, seepage.	Slope, too sandy, piping.

TABLE 8.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
Kartar:						
71, 72	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, seepage.	Slope, piping.
73, 74, 75	Slope, seepage	Large stones, seepage, piping.	No water			Slope, large stones, piping.
Koepke:						
76	Seepage	Piping, seepage.	No water	Slope	Slope, droughty, erodes easily.	Piping, erodes easily.
77, 78, 79, 80	Slope, seepage	Piping, seepage.	No water	Slope	Slope, droughty, erodes easily.	Slope, piping, erodes easily.
Leader:						
81	Seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, seepage.	Piping.
82, 83	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, seepage.	Slope, piping.
Leavenworth:						
84	Seepage	Low strength, piping.	Deep to water	Slope, floods, poor outlets.	Floods, seepage, slope.	Piping, poor outlets, droughty.
Lithic Xerochrepts:						
[1]85:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Cashmont part	Slope, seepage	Piping, large stones.	No water			Slope, large stones.
[1]86:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Conconully part	Slope, seepage	Piping, large stones.	No water			Slope, piping, large stones.
[1]87:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Donavan part	Slope, seepage	Large stones, piping.	No water			Slope, large stones.
Rock outcrop part						
[1]88:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Hum part	Slope	Shrink-swell, low strength, piping.	No water	Slope	Slope	Slope, piping.
[1]89:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Kartar part	Slope, seepage	Large stones, seepage, piping.	No water			Slope, large stones, piping.
[1]90:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Molson part	Slope	Piping, large stones.	No water			Slope, large stones.
[1]91:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
[1]91:						
Nevine part	Slope, seepage	Large stones, piping.	No water			Slope, large stones, piping.

TABLE 8.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
[1]92:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Newbon part	Slope	Large stones, piping.	No water			Slope, large stones.
[1]93:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Nighthawk part	Slope	Large stones, piping.	No water			Slope, large stones.
[1]94:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Republic part	Slope, seepage	Large stones, piping.	No water			Slope, large stones, piping.
[1]95:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Vallan part	Depth to rock, slope.	Thin layer, piping.	No water			Depth to rock, slope, droughty.
[1]96:						
Lithic Xerochrepts part	Slope, depth to rock.	Thin layer	No water			Slope, depth to rock.
Wadams part	Slope, seepage	Large stones, seepage, piping.	No water			Slope, large stones, piping.
Marsh:						
97						
Merkel:						
98	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, seepage, droughty.	Slope, piping.
99, 100	Slope, seepage	Large stones, seepage, piping.	No water			Slope, large stones.
Mires:						
101, 104	Slope, seepage	Seepage, piping.	No water	Slope, frost action.	Slope, droughty, seepage.	Slope, piping, droughty.
Mires:						
102	Slope, seepage	Large stones, seepage, piping.	No water			Slope, large stones.
103	Seepage	Seepage, piping.	No water	Slope, frost action.	Slope, droughty, seepage.	Piping, droughty.
Molson:						
105	Favorable	Piping, erodes easily.	No water	Slope	Slope, erodes easily.	Piping.
106, 107, 108, 109	Slope	Piping, erodes easily.	No water	Slope	Slope, erodes easily.	Slope, piping.
110, 111	Slope	Piping, large stones.	No water			Slope, large stones.
Nespelem:						
112	Favorable	Piping, low strength, hard to pack.	No water	Slope, percs slowly.	Slope, percs slowly, erodes easily.	Piping, erodes easily, percs slowly.
113, 114, 115, 116	Slope	Piping, low strength, hard to pack.	No water	Slope, percs slowly.	Slope, percs slowly, erodes easily.	Slope, piping, erodes easily.
117	Favorable	Piping, low strength, hard to pack.	Deep to water, percs slowly.	Excess sodium, percs slowly.	Excess sodium, percs slowly.	Piping, percs slowly.

TABLE 8.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
Nevine:						
118, 119	Slope, seepage	Piping	No water	Slope	Slope, erodes easily.	Slope, piping.
120, 121	Slope, seepage	Large stones, piping.	No water			Slope, large stones, piping.
Newbon:						
122, 125	Favorable	Piping	No water	Slope	Slope, erodes easily.	Erodes easily.
123, 124, 126, 127, 128, 129	Slope	Piping	No water	Slope	Slope, erodes easily.	Slope, erodes easily.
130	Slope	Large stones, piping.	No water			Slope, large stones.
Nighthawk:						
131	Favorable	Piping	No water	Slope, cutbanks cave.	Slope, erodes easily.	Favorable.
132, 133	Slope	Piping	No water	Slope, cutbanks cave.	Slope, erodes easily.	Slope, erodes easily.
134, 135, 136	Slope	Large stones, piping.	No water			Slope, large stones.
Okanogan:						
137	Favorable	Piping, low strength, hard to pack.	Deep to water	Floods	Floods	Piping.
Okanogan:						
138	Seepage	Piping, low strength, hard to pack.	Deep to water	Floods	Floods	Piping.
Owhi:						
139	Seepage	Piping, seepage.	No water	Cutbanks cave	Droughty, seepage.	Piping, droughty.
140, 141	Seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, seepage.	Piping, droughty.
142	Slope, seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, seepage.	Slope, piping, droughty.
143, 144	Slope, seepage	Piping, seepage, large stones.	No water			Slope, piping, large stones.
Pogue:						
145	Seepage	Piping, seepage.	No water	Cutbanks cave	Droughty, seepage.	Piping, droughty.
146, 149	Seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, seepage.	Piping, droughty.
147, 148, 150	Slope, seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, seepage.	Slope, piping, droughty.
151, 152	Slope, seepage	Piping, seepage, large stones.	No water			Slope, large stones.
Republic:						
153, 154, 157, 158, 159	Slope, seepage	Piping	No water	Slope, cutbanks cave.	Slope, seepage, droughty.	Slope, piping.
155	Slope, seepage	Large stones, piping.	No water			Slope, large stones, piping.
156	Seepage	Piping	No water	Slope, cutbanks cave.	Slope, seepage, droughty.	Piping.
160	Seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, erodes easily.	Piping, erodes easily.
Riverwash:						
161						

TABLE 8.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
Rock outcrop: 162						
Skaha: 163, 164	Seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, fast intake.	Piping, droughty.
165, 166	Slope, seepage	Piping, seepage.	No water	Slope, cutbanks cave.	Slope, droughty, fast intake.	Slope, piping, droughty.
Springdale: 167	Seepage	Seepage	No water	Cutbanks cave	Droughty, fast intake, seepage.	Droughty.
168	Seepage	Seepage	No water	Slope, cutbanks cave.	Droughty, seepage, slope.	Droughty.
169	Slope, seepage	Seepage	No water	Slope, cutbanks cave.	Droughty, seepage, slope.	Slope, droughty.
170, 171	Slope, seepage	Seepage	No water			Droughty, large stones, slope.
Synarep: 172	Seepage	Piping, low strength, hard to pack.	Favorable	Floods, poor outlets.	Wetness, floods.	Piping, wetness, poor outlets.
Tonasket: 173	Favorable	Piping, low strength, hard to pack.	No water	Percs slowly	Favorable	Erodes easily, piping, percs slowly.
174	Favorable	Piping, low strength, hard to pack.	No water	Slope, percs slowly.	Slope, erodes easily.	Erodes easily, piping, percs slowly.
175, 176, 177	Slope	Piping, low strength, hard to pack.	No water	Slope, percs slowly.	Slope. erodes easily.	Percs slowly, erodes easily, slope.
178	Slope	Piping, low strength, hard to pack.	No water			Slope, large stones, erodes easily.
Wadams: 179	Slope, seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Droughty, seepage, slope.	Slope, piping, droughty.
180, 181	Slope, seepage	Large stones, seepage, piping.	No water			Slope, large stones, piping.
Winthrop: 182	Seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Slope, droughty, seepage.	Piping, droughty, too sandy.
183	Slope, seepage	Seepage, large stones, piping.	No water			Slope, large stones, too sandy.
Xerofluvents: 184						

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aeneas:				
1, 2	Fair: frost action	Fair	Unsuited	Good.
3	Fair: frost action	Fair	Unsuited	Fair: slope.
Badland:				
4				
Boesel:				
5	Fair: frost action, wetness.	Good [2]	Good	Fair: area reclaim.
Boesel Variant:				
6	Fair: low strength, frost action.	Unsuited	Unsuited	Fair: small stones.
Cashmere:				
7, 8	Fair: frost action, low strength.	Poor: excess fines	Unsuited	Good.
9	Fair: frost action, low strength.	Poor: excess fines	Unsuited	Fair: slope.
10	Fair: slope, frost action, low strength.	Poor: excess fines	Unsuited	Poor: slope.
11	Poor: slope	Poor: excess fines	Unsuited	Poor: slope.
Cashmont:				
12, 13	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: small stones.
14	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: slope, small stones.
15	Fair: frost action	Poor: excess fines	Poor: excess fines	Poor: slope.
16, 17, 18	Fair: frost action	Poor: excess fines	Poor: excess fines	Poor: small stones.
19	Fair: large stones, frost action, slope.	Poor: excess fines	Poor: excess fines	Poor: large stones.
20	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: slope, large stones.
Chesaw:				
21	Poor: slope	Good	Good	Poor: small stones, slope.
Chesaw:				
22	Poor: slope	Good	Good	Poor: small stones, slope, large stones.
Colville:				
23, 24	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: too clayey.
Conconully:				
25	Fair: frost action	Poor: excess fines	Unsuited	Poor: small stones.
26	Fair: slope, frost action.	Poor: excess fines	Unsuited	Poor: small stones, slope.
27, 28	Fair: frost action	Poor: excess fines	Unsuited	Fair: slope.
29	Fair: slope, frost action.	Poor: excess fines	Unsuited	Poor: slope.
30	Fair: large stones, frost action.	Poor: excess fines	Poor: excess fines	Poor: large stones, small stones.
31, 32	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: large stones, small stones, slope.
Dinkelman:				
33	Fair: frost action	Poor: excess fines	Unsuited	Fair: slope, small stones.
34	Poor: slope	Poor: excess fines	Unsuited	Poor: slope.
35	Fair: frost action	Poor: excess fines	Unsuited	Poor: small stones.
36	Fair: frost action, large stones.	Poor: excess fines	Unsuited	Poor: large stones.
37	Poor: slope	Poor: excess fines	Unsuited	Poor: slope, large stones.
38	Poor: slope	Unsuited	Unsuited	Poor: slope.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Disautel:				
39	Fair: low strength, frost action.	Unsuited	Poor: excess fines	Fair: small stones.
40	Fair: low strength, frost action.	Unsuited	Poor: excess fines	Fair: small stones, slope.
41	Fair: slope, low strength, frost action.	Unsuited	Poor: excess fines	Poor: slope.
Disautel:				
42	Poor: slope	Unsuited	Poor: excess fines	Poor: small stones, slope.
43	Fair: large stones, frost action.	Unsuited	Poor: excess fines, large stones.	Poor: large stones.
44	Poor: slope	Unsuited	Poor: excess fines, large stones.	Poor: slope, large stones.
Donavan:				
45	Fair: frost action, low strength.	Poor: excess fines	Poor: excess fines	Good.
46	Fair: slope, frost action, low strength.	Poor: excess fines	Poor: excess fines	Poor: slope.
47	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: slope.
48	Fair: frost action	Poor: excess fines	Poor: excess fines	Poor: large stones.
49	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: large stones, slope.
[1]50:				
Donavan part	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: large stones, slope.
Rock outcrop part				
Emdent:				
51	Poor: frost action	Unsuited	Unsuited	Good.
Ewall:				
52, 53	Good	Fair: excess fines	Unsuited	Poor: too sandy.
54	Fair: slope	Fair: excess fines	Unsuited	Poor: slope, too sandy.
55	Poor: slope	Fair: excess fines	Unsuited	Poor: slope, too sandy.
Haley:				
56	Fair: frost action	Fair: excess fines	Unsuited	Good.
57	Fair: slope, frost action.	Fair: excess fines	Unsuited	Poor: slope.
58	Poor: slope	Fair: excess fines	Unsuited	Poor: slope.
Havillah:				
59	Poor: frost action	Unsuited	Poor: excess fines	Good.
Havillah:				
60	Poor: frost action	Unsuited	Poor: excess fines	Fair: slope.
61	Poor: frost action	Unsuited	Poor: excess fines	Poor: slope.
62	Poor: slope, frost action.	Unsuited	Poor: excess fines	Poor: slope.
63	Poor: slope, frost action.	Unsuited	Poor: excess fines	Poor: slope, large stones.
Hodgson:				
64	Fair: low strength, frost action, shrink-swell.	Unsuited	Unsuited	Fair: slope, too clayey.
Hum:				
65	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: slope, small stones.
Hunters:				
66	Poor: frost action	Unsuited	Unsuited	Good.
67	Poor: frost action	Unsuited	Unsuited	Fair: slope.
68	Poor: frost action	Unsuited	Unsuited	Poor: slope.
69	Poor: slope, frost action.	Unsuited	Unsuited	Poor: slope.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Karamin:				
70	Fair: frost action	Poor: excess fines	Unsuited	Poor: slope.
Kartar:				
71	Fair: frost action	Good [3]	Good	Fair: thin layer, small stones, slope.
72	Fair: slope, frost action.	Good [3]	Good	Poor: slope.
73	Poor: slope	Good [3]	Good	Poor: slope.
74	Fair: frost action, large stones.	Good [3]	Good	Poor: large stones.
75	Poor: slope	Good [3]	Good	Poor: slope, large stones.
Koepke:				
76	Poor: frost action	Poor: excess fines	Unsuited	Good.
77	Poor: frost action	Poor: excess fines	Unsuited	Fair: slope.
Koepke:				
78	Poor: frost action	Poor: excess fines	Unsuited	Poor: slope.
79	Poor: slope, frost action.	Poor: excess fines	Unsuited	Poor: slope.
80	Poor: frost action	Poor: excess fines	Unsuited	Poor: small stones.
Leader:				
81	Fair: frost action	Poor: excess fines	Unsuited	Fair: area reclaim.
82	Fair: slope, frost action.	Poor: excess fines	Unsuited	Poor: slope.
83	Poor: slope	Poor: excess fines	Unsuited	Poor: slope.
Leavenworth:				
84	Fair: low strength, frost action.	Unsuited	Unsuited	Good.
Lithic Xerochrepts:				
[1] 85:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Cashmont part	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: slope.
[1] 86:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Conconully part	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: large stones, small stones, slope.
[1] 87:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Donavan part	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: large stones, slope.
Rock outcrop part				
[1] 88:				
Lithic Xerochrepts part	Poor: thin layer	Unsuited	Unsuited	Poor: slope, thin layer.
Hum part	Poor: frost action, low strength.	Unsuited	Unsuited	Poor: slope.
[1] 89:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Kartar part	Poor: slope	Good [3]	Good	Poor: slope, large stones.
[1] 90:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Molson part	Poor: slope	Unsuited	Poor: excess fines	Poor: large stones, slope.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
[1]91:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Nevine part	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: large stones, slope.
[1]92:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Newbon part	Poor: slope	Unsuited	Poor: excess fines	Poor: slope, large stones.
[1]93:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Nighthawk part	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: slope, large stones, small stones.
[1]94:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Republic part	Poor: slope	Poor: excess fines	Unsuited	Poor: slope, large stones.
[1]95:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Vallan part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, area reclaim, thin layer.
[1]96:				
Lithic Xerochrepts part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Wadams part	Poor: slope, frost action.	Poor: excess fines	Poor: excess fines	Poor: slope, large stones, small stones.
Marsh:				
97				
Merkel:				
98	Fair: frost action	Poor: [2] excess fines	Poor: excess fines	Fair: slope, small stones.
99	Fair: frost action, large stones.	Poor: [2] excess fines, large stones.	Poor: excess fines, large stones.	Poor: large stones.
100	Poor: slope	Poor: [2] excess fines, large stones.	Poor: excess fines, large stones.	Poor: large stones, slope.
Mires:				
101	Poor: slope	Good	Good	Poor: small stones, slope.
102	Poor: slope	Good [2]	Good	Poor: slope, large stones.
103	Fair: frost action	Good	Good	Fair: thin layer.
104	Fair: frost action, slope.	Good	Good	Poor: small stones.
Molson:				
105	Poor: frost action	Unsuited	Poor: excess fines	Fair: small stones.
106	Poor: frost action	Unsuited	Poor: excess fines	Fair: slope, small stones.
107	Poor: frost action	Unsuited	Poor: excess fines	Poor: slope.
108	Poor: slope, frost action.	Unsuited	Poor: excess fines	Poor: slope.
109	Poor: frost action	Unsuited	Poor: excess fines	Poor: small stones.
Molson:				
110	Poor: frost action	Unsuited	Poor: excess fines	Poor: large stones, small stones, slope.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
111	Poor: slope, frost action.	Unsuited	Poor: excess fines	Poor: large stones, small stones, slope.
Nespelem:				
112	Poor: frost action	Unsuited	Unsuited	Good.
113	Poor: frost action	Unsuited	Unsuited	Fair: slope.
114, 115	Poor: frost action	Unsuited	Unsuited	Poor: slope.
116	Poor: slope, frost action.	Unsuited	Unsuited	Poor: slope.
117	Poor: frost action	Unsuited	Unsuited	Fair: thin layer, excess sodium.
Nevine:				
118	Fair: slope, frost action.	Poor: excess fines	Poor: excess fines	Poor: slope.
119	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: slope.
120	Fair: large stones, frost action.	Poor: excess fines	Poor: excess fines	Poor: large stones, small stones.
121	Poor: large stones, slope.	Poor: excess fines	Poor: excess fines	Poor: large stones, small stones, slope.
Newbon:				
122	Fair: frost action	Poor: [2] excess fines	Poor: excess fines	Fair: small stones, thin layer.
123	Fair: frost action	Poor: [2] excess fines	Poor: excess fines	Fair: slope, small stones, thin layer.
124	Fair: slope, frost action.	Poor: [2] excess fines	Poor: excess fines	Poor: slope.
125	Fair: frost action	Poor: [2] excess fines	Poor: excess fines	Poor: small stones.
126	Fair: slope, frost action.	Poor: [2] excess fines	Poor: excess fines	Poor: slope, small stones.
127, 128, 129	Poor: slope	Poor: [2] excess fines	Poor: excess fines	Poor: slope, small stones.
Newbon:				
130	Fair: slope, large stones, frost action.	Poor: [2] excess fines	Poor: excess fines	Poor: slope, large stones.
Nighthawk:				
131	Fair: frost action	Poor: [2] excess fines	Poor: excess fines	Fair: small stones, thin layer.
132	Fair: frost action	Poor: [2] excess fines	Poor: excess fines	Fair: slope, small stones, thin layer.
133	Fair: slope, frost action.	Poor: [2] excess fines	Poor: excess fines	Poor: slope.
134	Fair: slope, frost action, large stones.	Poor: excess fines	Poor: excess fines	Poor: slope, large stones, small stones.
135, 136	Poor: slope	Poor: excess fines	Poor: excess fines	Poor: slope, large stones, small stones.
Okanogan:				
137	Fair: low strength, frost action.	Unsuited	Unsuited	Good.
138	Fair: frost action, low strength.	Good [2]	Good	Good.
Owhi:				
139, 140	Fair: frost action	Fair: [2] excess fines	Fair: excess fines	Fair: thin layer, small stones.
141	Fair: frost action	Fair: [2] excess fines	Fair: excess fines	Poor: small stones.
142	Fair: slope, frost action.	Fair: [2] excess fines	Fair: excess fines	Poor: small stones, slope.
143	Fair: large stones, frost action.	Fair: [2] excess fines	Fair: excess fines	Poor: large stones, small stones.
144	Poor: slope	Fair: [2] excess fines	Fair: excess fines	Poor: slope, large stones, small stones.
Pogue:				
145, 146	Fair: frost action	Good	Good	Fair: thin layer.
147	Fair: frost action	Good	Good	Fair: slope, thin layer.
148	Poor: frost action, slope.	Good	Good	Poor: slope.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
149	Fair: frost action	Good	Good	Poor: small stones.
150	Poor: frost action, slope.	Good	Good	Poor: small stones, slope.
151	Fair: large stones, frost action.	Good	Good	Poor: large stones, small stones.
152	Poor: slope	Good	Good	Poor: slope, large stones, small stones.
Republic:				
153, 157	Fair: frost action	Poor: excess fines	Unsuited	Fair: slope, small stones.
154, 158	Fair: slope, frost action.	Poor: excess fines	Unsuited	Poor: slope.
155	Poor: slope	Poor: excess fines	Unsuited	Poor: slope, large stones.
156	Fair: frost action	Poor: excess fines	Unsuited	Fair: small stones.
159	Poor: slope	Poor: excess fines	Unsuited	Poor: slope.
160	Fair: frost action	Good [2]	Good	Fair: small stones.
Riverwash:				
161	---	---	---	---
Rock outcrop:				
162	---	---	---	---
Skaha:				
163, 164	Good	Good [2]	Good	Poor: too sandy, small stones, area reclaim.
165	Fair: slope	Good [2]	Good	Poor: slope, too sandy, small stones.
166	Poor: slope	Good [2]	Good	Poor: slope, too sandy, small stones.
Springdale:				
167, 168	Good	Good [2]	Good	Poor: small stones, area reclaim.
169	Fair: slope	Good [2]	Good	Poor: slope, small stones, area reclaim.
Springdale:				
170	Fair: large stones	Good [2]	Good	Poor: large stones, small stones.
171	Poor: slope	Good [2]	Good	Poor: small stones, large stones, slope.
Synarep:				
172	Poor: frost action	Unsuited	Unsuited	Good.
Tonasket:				
173, 174	Fair: frost action, low strength.	Unsuited	Unsuited	Good.
175	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
176	Fair: frost action, low strength, slope.	Unsuited	Unsuited	Poor: slope.
177	Poor: slope	Unsuited	Unsuited	Poor: slope.
178	Poor: slope	Unsuited	Unsuited	Poor: slope, large stones.
Wadams:				
179	Fair: frost action	Poor: excess fines	Poor: [3] excess fines	Fair: slope, small stones, area reclaim.
180	Fair: frost action, large stones.	Poor: excess fines	Poor: [3] excess fines	Poor: large stones, small stones.
181	Poor: slope, frost action.	Poor: excess fines	Poor: [3] excess fines	Poor: slope, large stones, small stones.
Winthrop:				
182	Good	Good [2]	Good	Poor: too sandy, small stones.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
183	Fair: slope, large stones.	Good [2]	Good	Poor: slope, large stones, too sandy.
Xerofluvents: 184				

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.
[2] Adequate recovery of sand after sieving.
[3] Adequate recovery of gravel after sieving.

Unless otherwise stated, the limitations in table 7 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 8 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a groundwater aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 8 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construc-

tion materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads, Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 10 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 10.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Soil Properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observations. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 10 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 10 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Descriptions of the Soils."

Texture is described in table 10 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation officials (AASHTO) (*1*). They are described in the PCA Soil Primer (*6*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol. for example, CL–ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A–1 to A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A–1 are coarse grained and low in content of fines. At the other extreme, in group A–7, are fine-grained soils. Highly organic soils are classified in group A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 10. Also in table 10 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 11 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 11. Salinity affects the suitability of a soil for crop production, its stability when used as

TABLE 10.—*Engineering*

[The symbol < means less than; > means greater than.

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Aeneas:				
1, 2, 3	0–26	Fine sandy loam	SM	A–4
	26–60	Sand, loamy sand	SP–SM, SM	A–3, A–1
Badland:				
4				
Boesel:				
5	0–8	Fine sandy loam	SM	A–4
	8–37	Fine sandy loam	SM	A–4
	37–60	Very gravelly sand	GW, GP	A–1
Boesel Variant:				
6	0–18	Silt loam	ML	A–4
	18–29	Silty clay loam	CL	A–6
	29–60	Gravelly loam, silt loam	GM, ML	A–4
Cashmere:				
7, 8, 9, 10, 11	0–44	Fine sandy loam	SM	A–4, A–2
	44–60	Loamy fine sand	SM	A–2
Cashmont:				
12, 13, 14, 15	0–8	Sandy loam	SM	A–2
	8–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	GM, SM	A–1, A–2
16, 17	0–8	Gravelly sandy loam	GM	A–1, A–2
	8–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	GM, SM	A–1, A–2
18	0–8	Very gravelly sandy loam	GP–GM, GM	A–1
	8–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	GM, SM	A–1, A–2
19, 20	0–8	Extremely stony sandy loam	SM	A–1, A–2
	8–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	GM, SM	A–1, A–2
Chesaw:				
21	0–5	Gravelly sandy loam	SM, GM	A–1, A–2
	5–60	Gravelly sand, very gravelly sand, very gravelly loamy sand.	GP, SP	A–1
Chesaw:				
22	0–5	Extremely stony sandy loam	SM	A–1, A–2
	5–60	Very gravelly sand, gravelly sand, very gravelly loamy sand.	GP, SP	A–1
Colville:				
23, 24	0–17	Silt loam	ML, CL–ML	A–4
	17–60	Silt loam, silty clay loam	ML, CL	A–6
Conconully:				
25, 26	0–13	Gravelly sandy loam	SM	A–1, A–2
	13–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	SM	A–1, A–2
27, 28, 29	0–13	Loam	ML, SM	A–4
	13–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	SM	A–1, A–2
30, 31, 32	0–13	Extremely stony loam	GM, ML	A–4
	13–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	SM, GM	A–1

properties and classifications

Absence of an entry means data were not estimated]

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	95–100	70–85	40–50	<30	NP–5
0	100	90–100	40–60	5–15		NP
0	100	95–100	75–85	40–50	<30	NP–5
0	90–100	90–100	70–80	35–50	<30	NP–5
0	40–50	25–35	10–20	0–5		NP
0	90–100	85–95	80–90	60–80	25–35	NP–10
0	85–95	75–85	70–85	60–80	30–40	10–20
0–5	60–80	60–80	50–75	35–65	25–35	NP–10
0	95–100	90–100	50–75	30–45	<30	NP–5
0	95–100	95–100	70–80	20–30		NP
0	100	95–100	60–65	30–35	<30	NP–5
0–10	50–70	50–65	25–55	20–35	<30	NP–5
0	50–65	50–65	30–45	20–35	<30	NP–5
0–10	50–70	50–65	25–55	20–35	<30	NP–5
0–10	25–40	20–30	15–20	5–15	<30	NP–5
0–10	50–70	50–65	25–55	20–35	<30	NP–5
30–50	65–80	65–75	40–50	20–30	<30	NP–5
0–10	50–70	50–65	25–55	20–35	<30	NP–5
0	40–75	40–70	25–50	15–30		NP
0–10	40–65	25–50	15–30	0–5		NP
25–55	60–75	60–65	40–50	20–30		NP
0–10	30–60	25–50	15–30	0–5		NP
0	100	95–100	95–100	85–95	25–35	5–10
0	100	95–100	95–100	85–95	35–40	10–20
0	70–80	60–75	45–60	20–35	<30	NP–5
0	70–80	60–75	40–55	20–35	<30	NP–5
0	85–95	85–95	60–80	45–65	25–35	NP–10
0	70–80	60–75	40–55	20–35	<30	NP–5
30–65	65–85	65–80	55–75	40–55	25–35	NP–10
5–20	55–70	55–65	35–45	15–25	<30	NP–5

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Dinkelman:				
33, 34	0–14	Sandy loam	SM	A–2, A–4
	14–28	Fine sandy loam, sandy loam	SM	A–4
	28–60	Gravelly fine sandy loam, gravelly sandy loam.	SM	A–2
35	0–14	Gravelly sandy loam	SM	A–2, A–4
	14–28	Fine sandy loam, sandy loam	SM	A–4
	28–60	Gravelly fine sandy loam, gravelly sandy loam.	SM	A–2
36, 37	0–14	Extremely stony sandy loam	SM	A–2
	14–28	Fine sandy loam, sandy loam	SM	A–4
	28–60	Gravelly fine sandy loam, gravelly sandy loam.	SM	A–2, A–1
Dinkelman:				
38	0–24	Loam	ML	A–4
	24–60	Cobbly sandy clay loam	SC	A–2
Disautel:				
39, 40, 41	0–16	Silt loam	ML	A–4
	16–24	Silt loam, very fine sandy loam, loam	ML	A–4
	24–60	Gravelly loam, gravelly silt loam, gravelly very fine sandy loam.	GM	A–2, A–4
42	0–16	Cobbly silt loam	ML	A–4
	16–24	Silt loam, very fine sandy loam, loam	ML	A–4
	24–60	Gravelly loam, gravelly silt loam, gravelly very fine sandy loam.	GM	A–2, A–4
43, 44	0–16	Extremely stony silt loam	ML	A–4
	16–24	Loam, silt loam, very fine sandy loam	ML	A–4
	24–60	Gravelly loam, gravelly silt loam, gravelly very fine sandy loam.	GM	A–2, A–4
Donavan:				
45, 46, 47	0–19	Loam	ML	A–4
	19–60	Gravelly loam, gravelly silt loam, gravelly sandy loam.	GM, SM	A–4, A–2
48, 49	0–19	Extremely stony loam	GM	A–4
	19–60	Gravelly loam, gravelly silt loam, gravelly sandy loam.	GM, SM	A–4, A–2
[1] 50:				
Donavan part	0–19	Extremely stony loam	GM	A–4
	19–60	Gravelly loam, gravelly silt loam, gravelly sandy loam.	GM, SM	A–4, A–2
Rock outcrop part				
Emdent:				
51	0–19	Loam	ML	A–4
	19–60	Silt loam, very fine sandy loam	ML	A–4
Ewall:				
52	0–15	Sand	SP–SM, SM	A–2, A–3
	15–60	Sand	SP–SM, SM	A–2, A–3
Ewall:				
53, 54, 55	0–15	Loamy fine sand	SM	A–2
	15–60	Sand	SP–SM, SM	A–2, A–3
Haley:				
56, 57, 58	0–25	Fine sandy loam	SM	A–4
	25–60	Sand	SP–SM	A–2, A–3
Havillah:				
59, 60, 61, 62	0–19	Silt loam	ML	A–4
	19–60	Gravelly silt loam, gravelly loam, gravelly clay loam.	GM	A–2, A–4
63	0–19	Extremely stony silt loam	ML	A–4
	19–60	Gravelly silt loam, gravelly loam, gravelly loam, gravelly clay loam.	GM	A–2, A–4

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	85–100	60–85	40–60	25–45	<30	NP–5
0	95–100	85–90	60–70	35–45	<30	NP–5
0	85–95	60–70	45–55	25–35	<30	NP–5
0	85–100	60–85	40–60	25–45	<30	NP–5
0	95–100	85–90	60–70	35–45	<30	NP–5
0	85–95	60–70	45–55	25–35	<30	NP–5
25–35	95–100	85–90	55–60	30–35	<30	NP–5
0	95–100	85–90	60–70	35–45	<30	NP–5
0	65–75	60–70	40–55	20–35	<30	NP–5
0	90–95	85–95	75–85	55–65	25–35	NP–10
20–40	90–95	60–70	50–60	25–35	30–40	10–20
0	90–95	85–95	80–90	50–75	<30	NP–5
0–5	85–95	80–90	75–85	50–70	25–35	NP–10
0–5	50–75	50–70	45–60	30–50	25–35	NP–10
25–35	75–85	75–85	75–80	60–70	<30	NP–5
0–5	85–95	80–90	75–85	50–70	25–35	NP–10
0–5	50–75	50–70	45–60	30–50	25–35	NP–10
20–40	75–95	75–95	70–90	50–70	<30	NP–5
0–5	85–95	80–90	75–85	50–70	25–35	NP–10
0–5	50–75	50–70	45–60	30–45	25–35	NP–10
0	95–100	95–100	70–85	55–70	20–30	NP–5
0–5	65–70	55–65	50–60	20–45	10–20	NP–5
15–30	60–75	60–70	55–65	40–50	20–30	NP–5
0–5	65–70	55–65	50–60	20–45	10–20	NP–5
15–30	60–75	60–70	55–65	40–50	20–30	NP–5
0–5	65–70	55–65	50–60	20–45	10–20	NP–5
0	100	100	90–100	55–90	20–40	NP–10
0	100	95–100	90–100	60–75	20–40	NP–10
0	100	100	50–70	5–15	----------	NP
0	100	100	50–70	5–15	----------	NP
0	100	100	70–80	25–35	----------	NP
0	100	100	50–70	5–15	----------	NP
0	95–100	90–100	65–75	40–50	----------	NP
0	95–100	90–100	60–70	5–15	----------	NP
0	95–100	85–95	80–90	65–75	<30	NP–5
0–5	55–70	50–70	45–65	30–45	25–35	NP–10
20–50	70–80	65–75	60–75	50–65	<30	NP–5
0–5	55–70	50–70	45–65	30–45	25–35	NP–10

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Hodgson:				
64	0–6	Silt loam	ML	A–4
	6–60	Clay loam, silt loam, silty clay loam	CL, ML	A–6, A–4
Hum:				
65	0–18	Silt loam	ML	A–4
	18–60	Loam, clay loam, gravelly silty clay loam.	CL	A–6
Hunters:				
66, 67, 68, 69	0–30	Silt loam	ML	A–4
	30–60	Silt loam	ML, CL	A–4, A–6
Karamin:				
70	0–23	Sandy loam	SM, ML	A–4
	23–60	Loamy fine sand, fine sand, sand	SM, SP–SM	A–2, A–3
Kartar:				
71, 72, 73	0–16	Sandy loam	SM	A–2
	16–28	Gravelly sandy loam, gravelly fine sandy loam.	SM	A–1, A–2
	28–50	Gravelly loamy sand	GP–GM, GM	A–1
	50–60	Very gravelly sand	GP	A–1
74, 75	0–16	Extremely stony sandy loam	SM	A–1, A–2
	16–28	Gravelly sandy loam, gravelly fine sandy loam.	SM	A–1, A–2
	28–50	Gravelly loamy sand	GP–GM, GM	A–1
	50–60	Very gravelly sand	GP	A–1
Koepke:				
76, 77, 78, 79	0–35	Silt loam	ML	A–4
	35–60	Gravelly loam, gravelly silt loam	SM	A–4
Koepke:				
80	0–35	Gravelly silt loam	ML	A–4
	35–60	Gravelly loam, gravelly silt loam	SM	A–4
Leader:				
81, 82, 83	0–25	Fine sandy loam	SM	A–4
	25–60	Loamy fine sand, fine sand	SM	A–2
Leavenworth:				
84	0–21	Silt loam	ML	A–4
	21–60	Stratified loam to coarse sand	SM, ML	A–4, A–2
Lithic Xerochrepts:				
[1]85:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Cashmont part	0–8	Extremely stony sandy loam	SM	A–1, A–2
	8–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	GM, SM	A–1, A–2
[1]86:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Conconully part	0–13	Extremely stony loam	GM, ML	A–4
	13–60	Gravelly sandy loam, gravelly fine sandy loam, gravelly coarse sandy loam.	SM, GM	A–1
[1]87:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Donavan part	0–19	Extremely stony loam	GM	A–4
	19–60	Gravelly loam, gravelly silt loam, gravelly sandy loam.	GM	A–4, A–2
Rock outcrop part				
[1]88:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	90–100	80–95	30–40	5–10
0	100	95–100	90–100	70–85	30–40	5–20
0	85–95	85–95	80–90	65–80	30–40	5–10
0	65–90	65–85	60–80	50–65	30–40	15–20
0	100	95–100	90–100	70–90	25–35	5–10
0	100	95–100	80–100	65–85	30–40	5–15
0	95–100	90–100	60–85	35–55	<30	NP–5
0	95–100	90–100	50–80	5–30	----------	NP
0	90–100	85–95	50–60	25–35	<30	NP–5
0–5	70–80	65–75	40–55	20–35	----------	NP
0–5	50–55	45–55	25–35	10–15	----------	NP
0–5	30–45	25–35	15–25	0–5	----------	NP
20–40	85–95	80–90	45–60	20–35	<30	NP–5
0–5	70–80	65–75	40–55	20–35	----------	NP
0–5	50–55	45–55	25–35	10–15	----------	NP
0–5	30–45	25–35	15–25	0–5	----------	NP
0	90–100	90–100	80–90	65–80	<30	NP–5
0–5	75–85	60–70	55–65	40–50	<30	NP–5
0	75–85	65–75	60–70	50–65	<30	NP–5
0–5	75–85	60–70	55–65	40–50	<30	NP–5
0	95–100	85–95	65–85	35–50	<30	NP–5
0	95–100	90–95	55–70	15–35	----------	NP
0	100	100	85–95	65–80	<30	NP–5
0	100	100	70–80	30–55	<30	NP–5
30–50	65–80	65–75	40–50	20–30	<30	NP–5
0–10	50–70	50–65	25–55	20–35	<30	NP–5
30–65	65–85	65–80	55–75	40–55	25–35	NP–10
5–20	55–70	55–65	35–45	15–25	<30	NP–5
15–30	60–75	60–70	55–65	40–50	20–30	NP–5
0–5	60–70	55–65	50–60	20–45	10–20	NP–5

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Hum part	0–18	Silt loam	ML	A–4
	18–60	Loam, clay loam, gravelly silty clay loam.	CL	A–6
[1]89:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Kartar part	0–16	Extremely stony sandy loam	SM	A–1, A–2
	16–28	Gravelly sandy loam, gravelly fine sandy loam.	SM	A–1, A–2
	28–50	Gravelly loamy sand	GP–GM, GM	A–1
	50–60	Very gravelly sand	GP	A–1
[1]90:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Molson part	0–18	Extremely stony silt loam	ML	A–4
	18–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
[1]91:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Nevine part	0–17	Extremely stony silt loam	ML	A–4
	17–32	Gravelly loam	GM, GM–GC	A–2, A–4
	32–60	Gravelly sandy loam, gravelly loam	GM, SM	A–1, A–2
[1]92:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Newbon part	0–13	Extremely stony loam	GM	A–4
	13–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
[1]93:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Nighthawk part	0–8	Extremely stony loam	GM	A–4
	8–22	Gravelly loam, gravelly silt loam, very gravelly loam.	GM	A–1, A–2
	22–60	Very gravelly loam, very gravelly coarse sandy loam.	GP–GM, GM	A–1
[1]94:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Republic part	0–16	Extremely stony sandy loam	SM	A–2, A–1
	16–60	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM	A–2, A–1
[1]95:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Vallan part	0–15	Gravelly silt loam	SM, ML	A–4
	15	Unweathered bedrock		
[1]96:				
Lithic Xerochrepts part	0–12	Variable		
	12	Unweathered bedrock		
Wadams part	0–4	Extremely stony sandy loam	SM	A–2, A–1
	4–31	Sandy loam, gravelly sandy loam	SM	A–1, A–2, A–4
	31–60	Cobbly loamy sand, cobbly loamy fine sand.	SP–SM, SM	A–1, A–2
Marsh:				
97				
Merkel:				
98	0–3	Sandy loam	SM	A–2
	3–26	Gravelly sandy loam	SM	A–2, A–1
	26–60	Very gravelly sandy loam, gravelly loamy coarse sand, very gravelly loamy sand.	GM, GP–GM	A–1
Merkel:				
99, 100	0–3	Extremely stony sandy loam	SM	A–2
	3–26	Gravelly sandy loam	SM	A–2, A–1
	26–60	Very gravelly sandy loam, gravelly loamy coarse sand, very gravelly loamy sand.	GM, GP–GM	A–1

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	85–95	85–95	80–90	65–80	30–40	5–10
0	65–90	65–85	60–80	50–65	30–40	15–20
20–40	85–95	80–90	45–60	20–35	<30	NP–5
0–5	70–80	65–75	40–55	20–35		NP
0–5	50–55	45–55	25–35	10–15		NP
0–5	30–45	25–35	15–25	0–5		NP
15–45	90–100	80–90	70–85	50–75	<30	NP–5
0–10	55–65	50–55	40–55	30–40	<30	NP–5
10–20	70–95	70–80	60–70	50–60	<30	NP–5
	55–65	50–60	35–50	25–40	<30	NP–5
	50–70	45–60	25–40	10–30		NP
20–40	60–70	50–60	45–55	35–45	25–35	NP–10
5–10	60–70	55–65	50–60	30–40	25–35	NP–10
10–30	60–70	55–60	45–55	35–45	25–35	NP–10
5–10	45–65	35–55	30–45	20–35	25–35	NP–10
5–15	35–50	25–35	15–25	5–20	<30	NP–5
25–40	75–85	70–80	45–55	20–30		NP
0–10	70–85	55–80	30–40	15–30		NP
0–5	75–90	65–85	60–80	45–60	<30	NP–5
20–35	70–90	55–80	35–55	15–35		NP
0–5	60–80	60–80	40–55	20–40		NP
30–40	55–65	55–65	35–55	10–20		NP
0–5	90–100	80–95	50–60	25–35	<30	NP–5
20–35	65–75	55–65	35–45	20–30	<30	NP–5
20–40	45–55	35–50	25–40	5–15		NP
20–40	75–85	70–80	50–55	20–30	<30	NP–5
10–20	65–75	55–65	35–45	20–30	<30	NP–5
20–40	45–55	35–50	25–40	5–15		NP

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Mires:				
101	0–13	Gravelly sandy loam	SM	A–2, A–1
	13–29	Gravelly sandy loam, gravelly loamy sand.	SM, SP–SM	A–1, A–2
	29–60	Gravelly coarse sand, very gravelly sand.	SP, GP	A–1
102	0–13	Extremely stony sandy loam	SM	A–2
	13–29	Gravelly sandy loam	SM	A–1, A–2
	29–60	Gravelly coarse sand, very gravelly sand, gravelly loamy sand.	GP, GP–GM	A–1
103	0–13	Loam	ML, SM	A–4
	13–29	Gravelly sandy loam, gravelly loamy sand.	SM, SP–SM	A–1
	29–60	Gravelly coarse sand, very gravelly sand.	SP, GP	A–1
104	0–13	Gravelly loam	ML, SM	A–4
	13–29	Gravelly sandy loam, gravelly loamy sand.	SM, SP–SM	A–1
	29–60	Gravelly coarse sand, very gravelly sand.	SP, GP	A–1
Molson:				
105, 106, 107, 108	0–18	Silt loam	ML	A–4
	18–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
109	0–18	Gravelly silt loam	GM, ML	A–4
	18–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
110, 111	0–18	Extremely stony silt loam	ML	A–4
	18–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
Nespelem:				
112, 113, 114, 115, 116	0–30	Silt loam	ML	A–4
	30–60	Stratified very fine sandy loam to silty clay loam.	ML	A–4
117	0–9	Silt loam	ML	A–4
	9–26	Silty clay loam	CL	A–6
	26–60	Stratified very fine sandy loam to silty clay loam.	ML	A–4
Nevine:				
118, 119	0–29	Silt loam	ML	A–4
	29–49	Gravelly loam	GM	A–2, A–4
	49–60	Gravelly sandy loam, gravelly loam	SM, GM	A–1, A–2
120, 121	0–29	Extremely stony silt loam	ML	A–4
	29–49	Gravelly loam	GM, GM–GC	A–2, A–4
	49–60	Gravelly sandy loam, gravelly loam	GM, SM	A–1, A–2
Newbon:				
122, 123, 124	0–13	Loam	ML	A–4
	13–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
125, 126, 127, 128	0–13	Gravelly loam	GM	A–4
	13–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
129	0–5	Very gravelly loam	GM	A–1
	5–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
130	0–13	Extremely stony loam	GM	A–4
	13–60	Gravelly loam, gravelly silt loam	GM	A–2, A–4
Nighthawk:				
131, 132, 133	0–8	Loam	ML	A–4
	8–22	Gravelly loam, gravelly silt loam, very gravelly loam.	GM	A–1, A–2, A–4
	22–60	Very gravelly loam, very gravelly coarse sandy loam.	GP–GM, GM	A–1
134, 135, 136	0–8	Extremely stony loam	GM	A–4
	8–22	Gravelly loam, gravelly silt loam, very gravelly loam.	GM	A–1, A–2
	22–60	Very gravelly loam, very gravelly coarse sandy loam.	GP–GM, GM	A–1
Okanogan:				
137	0–31	Loam	ML	A–4
	31–65	Stratified silt loam to sandy loam	ML	A–4

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0–5	75–85	60–75	40–55	20–30		NP
0–5	60–80	55–70	35–50	10–25		NP
0–5	35–60	30–40	15–25	0–5		NP
5–25	75–85	60–75	45–55	25–30		NP
0–5	60–80	55–70	35–50	15–30		NP
0–5	35–50	30–40	10–25	0–10		NP
0	80–90	65–80	55–75	35–55	<30	NP–5
0–5	60–80	55–70	35–50	10–25		NP
0–5	35–60	30–40	15–25	0–5		NP
0	80–90	65–80	55–75	35–55	<30	NP–5
0–5	60–80	55–70	35–50	10–25		NP
0–5	35–60	30–40	15–25	0–5		NP
0–5	95–100	85–95	80–90	65–75	<30	NP–5
0–5	55–65	50–55	40–55	30–40	<30	NP–5
0–5	60–80	55–75	45–65	35–60	<30	NP–5
0–5	55–65	50–55	40–55	30–40	<30	NP–5
15–45	90–100	80–90	70–85	50–75	<30	NP–5
0–10	55–65	50–55	40–55	30–40	<30	NP–5
0	100	100	95–100	80–90	<30	NP–5
0	100	100	95–100	75–90	<30	NP–5
0	100	100	90–100	80–90	<30	NP–5
0	100	100	95–100	85–95	25–35	10–20
0	100	100	95–100	75–90	<30	NP–5
0–5	85–95	80–90	70–85	50–70	<30	NP–5
	55–65	50–60	35–50	25–40	<30	NP–5
	50–70	45–60	25–40	10–30		NP
10–20	70–95	70–80	60–70	50–60	20–30	5–10
	55–65	50–60	35–50	25–40	<30	NP–5
	50–70	45–60	25–40	10–30		NP
0	85–90	80–85	70–80	50–60	25–35	NP–10
0–5	60–70	50–65	45–60	30–45	25–35	NP–10
0–5	65–75	60–70	55–65	40–50	25–35	NP–10
0–5	60–70	50–65	45–60	30–45	25–35	NP–10
0–10	35–45	25–35	20–30	15–25	<30	NP–5
0–5	60–70	50–65	45–60	30–45	25–35	NP–10
20–40	60–70	50–60	45–55	35–45	25–35	NP–10
5–10	60–70	55–65	50–60	30–40	25–35	NP–10
0	85–90	80–85	70–80	50–60	25–35	NP–5
0–5	45–65	35–50	30–45	20–40	25–35	NP–10
5–10	35–50	25–35	15–25	5–20	<30	NP–5
10–30	60–70	55–60	45–55	35–45	25–35	NP–10
5–10	45–65	35–55	30–45	20–35	25–35	NP–10
5–15	35–50	25–35	15–25	5–20	<30	NP–5
0	100	95–100	80–95	60–75	<30	NP–5
0	90–100	85–95	65–85	45–65	<30	NP–5

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
138	0–31	Loam	ML	A–4
	31–40	Stratified silt loam to sandy loam	ML, SM	A–4
	40–60	Very gravelly sand	GP	A–1
Owhi:				
139, 140	0–8	Fine sandy loam	SM	A–2, A–4
	8–31	Gravelly sandy loam, gravelly fine sandy loam, sandy loam.	SM	A–1, A–2
	31–60	Very gravelly coarse sand, gravelly loamy sand.	GP, GP–GM, GM	A–1
141, 142	0–8	Gravelly fine sandy loam	SM	A–1, A–2
	8–31	Gravelly sandy loam, gravelly fine sandy loam, sandy loam.	SM	A–1, A–2
	31–60	Very gravelly coarse sand, gravelly loamy sand.	GP, GP–GM, GM	A–1
143, 144	0–8	Extremely stony fine sandy loam	SM	A–2, A–4
	8–31	Gravelly sandy loam, gravelly fine sandy loam, sandy loam.	SM	A–1, A–2
	31–60	Very gravelly coarse sand, gravelly loamy sand.	GP, GP–GM, GM	A–1
Pogue:				
145, 146, 147, 148	0–12	Fine sandy loam	SM	A–4
	12–29	Gravelly fine sandy loam, gravelly sandy loam.	SM	A–2
	29–60	Very gravelly sand	GP, SP	A–1
149, 150	0–12	Gravelly fine sandy loam	SM	A–2, A–4
	12–29	Gravelly fine sandy loam, gravelly sandy loam.	SM	A–2
	29–60	Very gravelly sand	GP, SP	A–1
Pogue:				
151, 152	0–12	Extremely stony fine sandy loam	GM	A–4, A–2
	12–29	Gravelly fine sandy loam, gravelly sandy loam.	SM, GM	A–2
	29–60	Very gravelly sand	GP, SP	A–1
Republic:				
153, 154	0–16	Gravelly sandy loam	SM	A–4, A–2, A–1
	16–60	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM	A–2, A–1
155	0–16	Extremely stony sandy loam	SM	A–2, A–1
	16–60	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM	A–2, A–1
156, 157, 158, 159	0–16	Loam	SM, ML	A–4, A–2
	16–60	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM	A–2, A–1
160	0–16	Loam	ML	A–4
	16–40	Gravelly sandy loam	SM	A–2, A–1
	40–60	Very gravelly sand	GP	A–1
Riverwash:				
161				
Rock outcrop:				
162				
Skaha:				
163	0–7	Loamy sand	SM	A–2
	7–23	Gravelly loamy sand	SP–SM, SM	A–1, A–2
	23–60	Very gravelly coarse sand	GP	A–1
164, 165, 166	0–7	Gravelly loamy sand	SP–SM, SM	A–1, A–2
	7–23	Gravelly loamy sand	SP–SM, SM	A–1, A–2
	23–60	Very gravelly coarse sand	GP	A–1
Springdale:				
167, 168, 169	0–8	Sandy loam	SM	A–2, A–4
	8–30	Gravelly coarse sandy loam, gravelly sandy loam.	SM	A–2, A–1
	30–60	Gravelly loamy coarse sand, gravelly coarse sand, very gravelly sand.	GP, GP–GM	A–1

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	95–100	80–95	60–75	<30	NP–5
0	90–100	85–95	65–85	45–65	<30	NP–5
0–5	40–50	30–40	15–25	0–5		NP
0	90–100	80–90	60–75	30–50	<30	NP–5
0	70–80	60–75	40–70	20–35		NP
0–5	30–60	20–45	5–30	0–15		NP
0	70–80	60–70	40–60	20–35		NP
0	70–80	60–75	40–70	20–35		NP
0–5	30–60	20–45	5–30	0–15		NP
20–40	80–90	70–80	50–70	25–40	<30	NP–5
0–10	65–80	60–80	40–70	20–40		NP
0–5	30–60	20–45	5–30	0–15		NP
0	95–100	95–100	75–85	40–50	<30	NP–5
0–5	60–70	55–70	40–60	25–35		NP
5–15	40–55	30–35	15–25	0–5		NP
0–5	75–85	55–65	40–60	30–40	<30	NP–5
0–5	60–70	55–70	40–60	25–35		NP
5–15	40–55	30–35	15–25	0–5		NP
30–50	60–75	60–70	50–60	30–45	<30	NP–5
0–5	60–70	55–70	40–60	25–35		NP
5–15	40–55	30–35	15–25	0–5		NP
0–5	70–85	55–70	45–60	20–45	<30	NP–5
0–5	70–85	55–80	30–40	15–30		NP
25–40	75–85	70–80	45–55	20–30		NP
0–10	70–85	55–80	30–40	15–30		NP
0	90–100	80–90	60–70	30–60	<30	NP–5
0–5	70–85	55–80	30–40	15–30		NP
0	90–95	80–90	70–85	50–65	<30	NP–5
0	75–85	60–70	35–50	20–30		NP
0–5	40–50	30–35	15–25	2–5		NP
0	95–100	95–100	50–70	15–30		NP
0	65–70	50–60	25–45	10–20		NP
0–5	40–50	30–35	10–15	0–5		NP
0	70–80	55–65	30–45	10–20		NP
0	65–70	50–60	25–45	10–20		NP
0–5	40–50	30–35	10–15	0–5		NP
0	90–100	85–90	50–60	30–45	<30	NP–5
0	70–80	55–65	35–45	20–35		NP
0–5	35–45	30–45	10–20	0–10		NP

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Springdale:				
170, 171	0–8	Extremely stony sandy loam	SM	A–2
	8–30	Gravelly coarse sandy loam, gravelly sandy loam.	SM	A–2, A–1
	30–60	Gravelly loamy coarse sand, gravelly coarse sand, very gravelly sand.	GP, GP–GM	A–1
Synarep:				
172	0–46	Silt loam	ML	A–4
	46–60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML	A–2, A–4
Tonasket:				
173, 174, 175, 176, 177	0–28	Silt loam	ML	A–4
	28–65	Silt loam	ML	A–4
178	0–8	Extremely stony silt loam	ML	A–4
	8–28	Silt loam	ML	A–4
	28–65	Silt loam	ML	A–4
Wadams:				
179	0–4	Sandy loam	SM	A–2, A–4
	4–31	Sandy loam, gravelly sandy loam	SM	A–1, A–2, A–4
	31–60	Cobbly loamy sand, cobbly loamy fine sand.	SP–SM, SM	A–1, A–2
180, 181	0–4	Extremely stony sandy loam	SM	A–2, A–1
	4–31	Sandy loam, gravelly sandy loam	SM	A–1, A–2, A–4
	31–60	Cobbly loamy sand, cobbly loamy fine sand.	SP–SM, SM	A–1, A–2
Winthrop:				
182	0–25	Gravelly loamy sand	SP–SM, SM	A–1
	25–60	Very gravelly sand	GP	A–1
183	0–13	Extremely stony loamy sand	SP–SM, SM	A–1
	13–25	Gravelly loamy sand	SP–SM, SM	A–1
	25–60	Very gravelly sand	GP	A–1
Xerofluvents:				
184	0–60	Variable		

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil and water features

Table 12 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
25–35	80–90	75–85	45–55	20–30		NP
0–5	70–80	55–65	35–45	20–35		NP
0–5	35–45	30–45	10–20	0–10		NP
0	100	100	95–100	75–90		NP
0	100	85–95	60–75	30–65		NP
0	100	100	90–100	70–80	<30	NP–5
0–5	90–100	90–100	90–100	70–85	<30	NP–5
20–35	90–100	85–95	75–85	65–80	<30	NP–5
0–10	90–100	90–100	90–100	70–85	<30	NP–5
0–5	90–100	90–100	90–100	70–85	<30	NP–5
0	75–90	75–90	50–65	25–45		NP
0–5	60–80	60–80	40–55	20–40		NP
30–40	55–65	55–65	35–55	10–20		NP
20–35	70–90	55–80	35–55	15–35		NP
0–5	60–80	60–80	40–55	20–40		NP
30–40	55–65	55–65	35–55	10–20		NP
0	60–70	50–60	25–45	5–20		NP
0	30–40	30–35	15–25	0–5		NP
15–35	55–65	45–55	20–40	5–20		NP
0	60–70	50–60	25–45	5–20		NP
0–5	30–40	30–35	15–25	0–5		NP

behavior of the whole mapping unit.

when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth

TABLE 11.—*Physical and chemical*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*
Aeneas:					
1, 2, 3	0–26	2.0–6.0	0.13–0.15	6.1–7.3	<2
	26–60	6.0–20	0.05–0.07	6.6–7.8	<2
Badland:					
4.					
Boesel:					
5	0–8	0.6–2.0	0.13–0.15	6.6–7.3	<2
	8–37	0.6–6.0	0.11–0.13	6.6–7.3	<2
	37–60	>20	0.04–0.06	6.6–7.3	<2
Boesel Variant:					
6	0–18	0.6–2.0	0.19–0.21	6.6–7.3	<2
	18–29	0.2–0.6	0.15–0.21	6.1–6.5	<2
	29–60	0.6–2.0	0.13–0.16	6.1–6.5	<2
Cashmere:					
7, 8, 9, 10, 11	0–44	2.0–6.0	0.13–0.15	6.1–7.8	<2
	44–60	2.0–6.0	0.08–0.11	6.1–7.8	<2
Cashmont:					
12, 13, 14, 15	0–8	2.0–6.0	0.11–0.13	6.6–7.3	<2
	8–60	2.0–6.0	0.09–0.11	6.6–7.3	<2
16, 17	0–8	2.0–6.0	0.09–0.11	6.6–7.3	<2
	8–60	2.0–6.0	0.09–0.11	6.6–7.3	<2
18	0–8	2.0–6.0	0.06–0.08	6.6–7.3	<2
	8–60	2.0–6.0	0.09–0.11	6.6–7.3	<2
19, 20	0–8	2.0–6.0	0.06–0.08	6.6–7.3	<2
	8–60	2.0–6.0	0.09–0.11	6.6–7.3	<2
Chesaw:					
21	0–5	6.0–20	0.05–0.10	6.6–7.3	<2
	5–60	>20	0.02–0.04	6.6–7.8	<2
22	0–5	6.0–20	0.07–0.09	6.6–7.3	<2
	5–60	>20	0.02–0.04	6.6–7.8	<2
Colville:					
23, 24	0–17	0.6–2.0	0.19–0.21	7.9–8.4	<2
	17–60	0.2–0.6	0.19–0.21	7.9–9.0	<4
Conconully:					
25, 26	0–13	2.0–6.0	0.11–0.12	6.6–7.3	<2
	13–60	2.0–6.0	0.10–0.12	6.6–7.3	<2
27, 28, 29	0–13	0.6–2.0	0.16–0.18	6.6–7.3	<2
	13–60	2.0–6.0	0.10–0.12	6.6–7.3	<2
30, 31, 32	0–13	0.6–2.0	0.11–0.13	6.6–7.3	<2
	13–60	2.0–6.0	0.08–0.10	6.6–7.3	<2
Dinkelman:					
33, 34, 35	0–14	2.0–6.0	0.10–0.13	6.6–7.3	<2
	14–28	2.0–6.0	0.13–0.15	6.6–7.3	<2
	28–60	2.0–6.0	0.11–0.12	6.6–7.3	<2
36, 37	0–14	2.0–6.0	0.11–0.13	6.6–7.3	<2
	14–28	2.0–6.0	0.13–0.15	6.6–7.3	<2
	28–60	2.0–6.0	0.11–0.12	6.6–7.3	<2
38	0–24	0.6–2.0	0.16–0.18	6.6–7.3	<2
	24–60	0.2–0.6	0.14–0.16	6.6–7.3	<2
Disautel:					
39, 40, 41	0–16	0.6–2.0	0.16–0.18	6.6–7.8	<2
	16–24	0.6–2.0	0.16–0.18	6.6–7.8	<2
	24–60	0.6–2.0	0.13–0.15	7.4–9.0	<4
42	0–16	0.6–2.0	0.12–0.14	6.6–7.8	<2
	16–24	0.6–2.0	0.16–0.18	6.6–7.8	<2
	24–60	0.6–2.0	0.13–0.15	7.4–9.0	<4
43, 44	0–16	0.6–2.0	0.13–0.15	6.6–7.8	<2
	16–24	0.6–2.0	0.16–0.18	6.6–7.8	<2
	24–60	0.6–2.0	0.13–0.15	7.4–9.0	<4

properties of soils

tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Low	0.37	3	3
Low	Moderate	Low	0.10		
Low	Low	Low			
Low	Low	Low			
Low	Moderate	Low			
Low	Moderate	Low			
Moderate	High	Low			
Low	High	Low			
Low	Low	Low	0.32	5	3
Low	Low	Low	0.37		
Low	Low	Low	0.20	5	3
Low	Moderate	Low	0.17		
Low	Low	Low	0.17	5	4
Low	Moderate	Low	0.17		
Low	Low	Low	0.10	5	5
Low	Moderate	Low	0.17		
Low	Low	Low	0.17	5	4
Low	Moderate	Low	0.17		
Low	Low	Low	0.20	1	3
Low	Moderate	Low	0.10		
Low	Low	Low	0.20	1	3
Low	Moderate	Low	0.10		
Low	High	Low			
Moderate	High	Low			
Low	Low	Low	0.32	5	3
Low	Moderate	Low	0.32		
Low	Low	Low	0.32	5	5
Low	Moderate	Low	0.32		
Low	Low	Low	0.28	5	
Low	Moderate	Low	0.32		
Low	Low	Low	0.20	5	
Low	Low	Low	0.20		
Low	Low	Low	0.17		
Low	Low	Low	0.20	3	
Low	Low	Low	0.28		
Low	Low	Low	0.24		
Low	Low	Low	0.32	5	
Low	Low	Low	0.24		
Moderate	Low	Low			
Low	Moderate	Low	0.37	5	5
Low	Moderate	Low	0.37		
Low	High	Low	0.32		
Low	Moderate	Low	0.32	5	
Low	Moderate	Low	0.37		
Low	High	Low	0.32		
Low	Moderate	Low	0.32	5	
Low	Moderate	Low	0.37		
Low	High	Low	0.32		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*
Donavan:					
45, 46, 47	0–19	0.6–2.0	0.16–0.19	6.1–6.5	<2
	19–60	0.6–2.0	0.09–0.11	6.6–7.3	<2
48, 49	0–19	0.6–2.0	0.16–0.19	6.1–6.5	<2
	19–60	0.6–2.0	0.09–0.11	6.6–7.3	<2
[1] 50:					
Donavan part	0–19	0.6–2.0	0.16–0.19	6.1–6.5	<2
	19–60	0.6–2.0	0.09–0.11	6.6–7.3	<2
Rock outcrop part.					
Emdent:					
51	0–19	0.6–2.0	0.16–0.20	7.9–8.4	<2
	19–60	0.6–2.0	0.16–0.20	7.9–8.4	<4
Ewall:					
52	0–15	>20	0.05–0.07	6.6–7.3	<2
	15–60	>20	0.05–0.07	6.6–7.3	<2
53, 54, 55	0–15	6.0–20	0.08–0.11	6.6–7.3	<2
	15–60	>20	0.05–0.07	6.6–7.3	<2
Haley:					
56, 57, 58	0–25	2.0–6.0	0.13–0.15	6.6–7.3	<2
	25–60	6.0–20	0.05–0.07	6.6–7.3	<2
Havillah:					
59, 60, 61, 62	0–19	0.6–2.0	0.19–0.21	6.6–7.3	<2
	19–60	0.2–0.6	0.14–0.18	6.6–9.0	<4
63	0–19	0.6–2.0	0.16–0.19	6.6–7.3	<2
	19–60	0.2–2.0	0.14–0.18	6.6–9.0	<4
Hodgson:					
64	0–6	0.6–2.0	0.19–0.21	6.1–7.3	<2
	6–60	0.2–0.6	0.18–0.20	6.1–9.0	<4
Hum:					
65	0–18	0.6–2.0	0.18–0.21	6.6–7.3	<2
	18–60	0.2–0.6	0.14–0.17	6.6–7.3	<2
Hunters:					
66, 67, 68, 69	0–30	0.6–2.0	0.19–0.21	6.1–7.3	<2
	30–60	0.2–0.6	0.18–0.21	6.6–8.4	<2
Karamin:					
70	0–23	2.0–6.0	0.12–0.15	5.1–6.5	<2
	23–60	6.0–20	0.05–0.09	5.6–7.3	<2
Kartar:					
71, 72, 73	0–16	2.0–6.0	0.11–0.13	6.6–7.3	<2
	16–28	2.0–6.0	0.09–0.11	6.6–7.3	<2
	28–50	>20	0.04–0.06	6.6–7.3	<2
	50–60	>20	0.02–0.04	6.6–7.3	<2
74, 75	0–16	2.0–6.0	0.10–0.12	6.6–7.3	<2
	16–28	2.0–6.0	0.09–0.11	6.6–7.3	<2
	28–50	>20	0.04–0.06	6.6–7.3	<2
	50–60	>20	0.02–0.04	6.6–7.3	<2
Koepke:					
76, 77, 78, 79	0–35	0.6–2.0	0.17–0.21	6.6–7.3	<2
	35–60	0.6–2.0	0.12–0.14	8.5–9.0	<4
80	0–35	0.6–2.0	0.16–0.18	6.6–7.3	<2
	35–60	0.6–2.0	0.12–0.14	8.5–9.0	<4
Leader:					
81, 82, 83	0–25	2.0–6.0	0.13–0.15	6.1–6.5	<2
	25–60	6.0–20	0.06–0.09	6.6–7.3	<2
Leavenworth:					
84	0–21	0.6–2.0	0.17–0.19	6.6–7.8	<2
	21–60	0.6–20	0.08–0.12	6.6–7.8	<2

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Moderate	Low	0.37	5	
Low	Low	Low	0.32		
Low	Moderate	Low	0.32	5	
Low	Low	Low	0.32		
Low	Moderate	Low	0.32	5	
Low	Low	Low	0.32		
Low	High	Low			
Low	High	Low			
Low	Low	Low	0.10	2	1
Low	Low	Low	0.10		
Low	Low	Low	0.37	2	2
Low	Low	Low	0.10		
Low	Low	Low	0.37	3	3
Low	Low	Low	0.10		
Low	Low	Low	0.43	5	5
Low	Moderate	Low	0.32		
Low	Low	Low	0.37	5	
Low	Moderate	Low	0.32		
Low	Moderate	Low	0.43	5	
Moderate	High	Low	0.32		
Low	Moderate	Low	0.32	5	5
Moderate	Moderate	Low	0.32		
Low	Moderate	Low	0.43	5	5
Low	High	Low	0.43		
Low	Low	Low	0.37	2	
Low	Low	Low	0.17		
Low	Low	Low	0.24	3	3
Low	Low	Low	0.20		
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.20	3	
Low	Low	Low	0.20		
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.37	5	
Low	High	Low	0.20		
Low	Low	Low	0.32	5	
Low	High	Low	0.20		
Low	Low	Low	0.37	3	3
Low	Low	Low	0.17		
Low	Moderate	Low			
Low	High	Low			

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*
Lithic Xerochrepts:					
[1]85:					
Lithic Xerochrepts part	0–12				
	12				
Cashmont part	0–8	2.0–6.0	0.06–0.08	6.6–7.3	<2
	8–60	2.0–6.0	0.09–0.11	6.6–7.3	<2
[1]86:					
Lithic Xerochrepts part	0–12				
	12				
Conconully part	0–13	0.6–2.0	0.11–0.13	6.6–7.3	<2
	13–60	2.0–6.0	0.08–0.10	6.6–7.3	<2
[1]87:					
Lithic Xerochrepts part	0–12				
	12				
Donavan part	0–19	0.6–2.0	0.16–0.19	6.1–6.5	<2
	19–60	0.6–2.0	0.09–0.11	6.6–7.3	<2
Rock outcrop part.					
[1]88:					
Lithic Xerochrepts part	0–12				
	12				
Hum part	0–18	0.6–2.0	0.18–0.21	6.6–7.3	<2
	18–60	0.2–0.6	0.14–0.17	6.6–7.3	<2
[1]89:					
Lithic Xerochrepts part	0–12				
	12				
Kartar part	0–16	2.0–6.0	0.10–0.12	6.6–7.3	<2
	16–28	2.0–6.0	0.09–0.11	6.6–7.3	<2
	28–50	>20	0.04–0.06	6.6–7.3	<2
	50–60	>20	0.02–0.04	6.6–7.3	<2
[1]90:					
Lithic Xerochrepts part	0–12				
	12				
Molson part	0–18	0.6–2.0	0.16–0.18	6.1–7.3	<2
	18–60	0.6–2.0	0.16–0.18	6.6–8.4	<4
[1]91:					
Lithic Xerochrepts part	0–12				
	12				
Nevine part	0–17	0.6–2.0	0.16–0.18	6.1–7.3	<2
	17–32	0.6–2.0	0.14–0.16	6.1–7.3	<2
	32–60	2.0–6.0	0.10–0.12	6.1–7.8	<2
[1]92:					
Lithic Xerochrepts part	0–12				
	12				
Newbon part	0–13	0.6–2.0	0.13–0.15	6.6–7.3	<2
	13–60	0.6–2.0	0.13–0.15	6.6–7.3	<2
[1]93:					
Lithic Xerochrepts part	0–12				
	12				
Nighthawk part	0–8	0.6–2.0	0.14–0.17	6.6–7.3	<2
	8–22	0.6–2.0	0.10–0.13	7.4–7.8	<2
	22–60	0.6–2.0	0.07–0.09	>7.9	<4
[1]94:					
Lithic Xerochrepts part	0–12				
	12				
Republic part	0–16	0.6–2.0	0.10–0.12	6.6–7.3	<2
	16–60	2.0–6.0	0.09–0.11	6.6–8.4	<4
[1]95:					
Lithic Xerochrepts part	0–12				
	12				
Vallan part	0–15	0.6–2.0	0.16–0.19	6.1–7.3	<2
	15				
[1]96:					
Lithic Xerochrepts part	0–12				
	12				
Wadams part	0–4	2.0–6.0	0.10–0.12	6.6–7.3	<2
	4–31	2.0–6.0	0.10–0.12	6.6–7.3	<2
	31–60	>20	0.05–0.07	6.6–7.3	<2
Marsh:					
97.					

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Low	0.17	5	4
Low	Moderate	Low	0.17		
Low	Low	Low	0.28	5	
Low	Moderate	Low	0.32		
Low	Moderate	Low	0.32	5	
Low	Low	Low	0.32		
Low	Moderate	Low	0.32	5	5
Moderate	Moderate	Low	0.32		
Low	Low	Low	0.20	3	
Low	Low	Low	0.20		
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.32	5	
Low	High	Low	0.32		
Low	Moderate	Low	0.37	5	
Low	Moderate	Low	0.32		
Low	Moderate	Low	0.28		
Low	Low	Low	0.32	5	
Low	Low	Low	0.32		
Low	Low	Low	0.28	2	
Low	Moderate	Low	0.28		
Low	High	Low	0.24		
Low	Low	Low	0.28	5	
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.37	1	
Low	Low	Low	0.20	5	
Low	Low	Low	0.17		
Low	Low	Low	0.17		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*
Merkel:					
98	0–3	0.6–2.0	0.09–0.11	6.1–7.3	<2
	3–26	2.0–6.0	0.08–0.10	6.1–7.3	<2
	26–60	>20	0.05–0.07	6.1–7.3	<2
99, 100	0–3	0.6–2.0	0.08–0.11	6.1–7.3	<2
	3–26	2.0–6.0	0.08–0.10	6.1–7.3	<2
	26–60	>20	0.05–0.07	6.1–7.3	<2
Mires:					
101	0–13	2.0–6.0	0.08–0.11	6.6–7.8	<2
	13–29	>6.0	0.06–0.08	6.6–7.8	<2
	29–60	>20	0.02–0.04	6.6–7.8	<2
102	0–13	2.0–6.0	0.07–0.09	6.6–7.8	<2
	13–29	>6.0	0.06–0.08	6.6–7.8	<2
	29–60	>20	0.02–0.04	6.6–7.8	<2
103, 104	0–13	0.6–2.0	0.15–0.17	6.6–7.3	<2
	13–29	>6.0	0.06–0.08	6.6–7.8	<2
	29–60	>20	0.02–0.04	6.6–7.8	<2
Molson:					
105, 106, 107, 108	0–18	0.6–2.0	0.17–0.20	6.1–7.3	<2
	18–60	0.6–2.0	0.13–0.15	6.6–8.4	<4
109	0–18	0.6–2.0	0.13–0.15	6.1–7.3	<2
	18–60	0.6–2.0	0.13–0.15	6.6–8.4	<4
110, 111	0–18	0.6–2.0	0.16–0.18	6.1–7.3	<2
	18–60	0.6–2.0	0.16–0.18	6.6–8.4	<4
Nespelem:					
112, 113, 114, 115, 116	0–26	0.6–2.0	0.19–0.21	6.1–7.3	<2
	26–60	0.2–0.6	0.16–0.18	7.9–8.4	<4
117	0–9	0.6–2.0	0.19–0.21	8.5–9.0	2–8
	9–26	0.06–0.2	0.19–0.21	8.5–9.0	2–8
	26–60	0.2–0.6	0.16–0.18	7.9–8.4	2–8
Nevine:					
118, 119	0–29	0.6–2.0	0.18–0.21	6.1–7.3	<2
	29–49	0.6–2.0	0.14–0.16	6.1–7.3	<2
	49–60	2.0–6.0	0.10–0.12	6.1–7.8	<2
120, 121	0–29	0.6–2.0	0.16–0.18	6.1–7.3	<2
	29–49	0.6–2.0	0.14–0.16	6.1–7.3	<2
	49–60	2.0–6.0	0.10–0.12	6.1–7.8	<2
Newbon:					
122, 123, 124	0–13	0.6–2.0	0.16–0.18	6.6–7.3	<2
	13–60	0.6–2.0	0.13–0.15	6.6–7.3	<2
125, 126, 127, 128, 130	0–13	0.6–2.0	0.13–0.15	6.6–7.3	<2
	13–60	0.6–2.0	0.13–0.15	6.6–7.3	<2
129	0–5	0.6–2.0	0.10–0.12	6.6–7.3	<2
	5–60	0.6–2.0	0.13–0.15	6.6–7.3	<2
Nighthawk:					
131, 132, 133	0–8	0.6–2.0	0.16–0.18	6.6–7.3	<2
	8–22	0.6–2.0	0.10–0.13	7.4–7.8	<2
	22–60	0.6–2.0	0.07–0.09	>7.9	<4
134, 135, 136	0–8	0.6–2.0	0.14–0.17	6.6–7.3	<2
	8–22	0.6–2.0	0.10–0.13	7.4–7.8	<2
	22–60	0.6–2.0	0.07–0.09	>7.9	<4
Okanogan:					
137	0–31	0.6–2.0	0.16–0.18	6.6–7.3	<2
	31–65	0.6–2.0	0.14–0.17	6.6–8.4	<4
138	0–31	0.6–2.0	0.16–0.18	6.6–7.3	<2
	31–40	0.6–2.0	0.14–0.17	6.6–7.3	<2
	40–60	>20	0.02–0.04	6.6–7.3	<2
Owhi:					
139, 140	0–8	2.0–6.0	0.12–0.14	6.1–6.5	<2
	8–31	2.0–6.0	0.09–0.11	6.6–7.3	<2
	31–60	>20	0.01–0.03	6.6–7.3	<2

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Low	0.24	4	
Low	Low	Low	0.24		
Low	Low	Low	0.17		
Low	Low	Low	0.20	4	
Low	Low	Low	0.24		
Low	Low	Low	0.17		
Low	Low	Low	0.20	2	8
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.10		
Low	Low	Low	0.20	2	
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.37	2	5
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.10		
Low	Low	Low	0.37	5	5
Low	High	Low	0.32		
Low	Low	Low	0.32	5	5
Low	High	Low	0.32		
Low	Low	Low	0.32	5	
Low	High	Low	0.32		
Low	Low	Low	0.43	5	5
Low	Moderate	Low	0.43		
Low	High	Low			
Moderate	High	Low			
Low	High	Low			
Low	Moderate	Low	0.43	5	
Low	Moderate	Low	0.32		
Low	Moderate	Low	0.28		
Low	Moderate	Low	0.37	5	
Low	Moderate	Low	0.32		
Low	Moderate	Low	0.28		
Low	Low	Low	0.37	5	5
Low	Low	Low	0.32		
Low	Low	Low	0.32	5	5
Low	Low	Low	0.32		
Low	Low	Low	0.28	5	
Low	Low	Low	0.32		
Low	Low	Low	0.32	2	5
Low	High	Low	0.28		
Low	High	Low	0.24		
Low	Low	Low	0.28	2	
Low	Moderate	Low	0.28		
Low	High	Low	0.24		
Low	Low	Low			5
Low	High	Low			
Low	Low	Low			5
Low	Low	Low			
Low	Low	Low			
Low	Low	Low	0.32	2	3
Low	Low	Low	0.20		
Low	Low	Low	0.10		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*
141, 142	0–8	2.0–6.0	0.11–0.13	6.6–7.3	<2
	8–31	2.0–6.0	0.09–0.11	6.6–7.3	<2
	31–60	>20	0.01–0.03	6.6–7.3	<2
143, 144	0–8	2.0–6.0	0.10–0.13	6.1–6.5	<2
	8–31	2.0–6.0	0.09–0.11	6.6–7.3	<2
	31–60	>20	0.01–0.03	6.6–7.3	<2
Pogue:					
145, 146, 147, 148	0–12	2.0–6.0	0.13–0.15	6.6–7.3	<2
	12–29	2.0–6.0	0.12–0.14	6.6–7.3	<2
	29–60	>20	0.02–0.04	6.6–7.3	<2
149, 150	0–12	2.0–6.0	0.12–0.14	6.6–7.3	<2
	12–29	2.0–6.0	0.12–0.14	6.6–7.3	<2
	29–60	>20	0.02–0.04	6.6–7.3	<2
151, 152	0–12	2.0–6.0	0.12–0.14	6.6–7.3	<2
	12–29	2.0–6.0	0.12–0.14	6.6–7.3	<2
	29–60	>20	0.02–0.04	6.6–7.3	<2
Republic:					
153, 154	0–16	0.6–2.0	0.12–0.15	6.6–7.3	<2
	16–60	2.0–6.0	0.09–0.11	6.6–8.4	<4
155	0–16	0.6–2.0	0.10–0.12	6.6–7.3	<2
	16–60	2.0–6.0	0.09–0.11	6.6–8.4	<4
156, 157, 158, 159	0–16	0.6–2.0	0.13–0.16	6.6–7.3	<2
	16–60	2.0–6.0	0.09–0.11	6.6–8.4	<4
160	0–16	0.6–2.0	0.16–0.18	6.6–7.3	<2
	16–40	2.0–6.0	0.09–0.11	6.6–7.3	<2
	40–60	>20	0.02–0.04	6.6–7.3	<2
Riverwash:					
161.					
Rock outcrop:					
162.					
Skaha:					
163	0–7	6.0–20	0.06–0.08	6.6–7.3	<2
	7–23	6.0–20	0.05–0.07	6.6–7.3	<2
	23–60	>20	0.02–0.04	6.6–7.3	<2
164, 165, 166	0–7	6.0–20	0.05–0.07	6.6–7.3	<2
	7–23	6.0–20	0.05–0.07	6.6–7.3	<2
	23–60	>20	0.02–0.04	6.6–7.3	<2
Springdale:					
167, 168, 169	0–8	2.0–6.0	0.11–0.13	5.6–7.3	<2
	8–30	2.0–6.0	0.09–0.11	5.6–7.3	<2
	30–60	>20	0.02–0.04	5.6–7.3	<2
170, 171	0–8	2.0–6.0	0.08–0.10	5.6–7.3	<2
	8–30	2.0–6.0	0.09–0.11	5.6–7.3	<2
	30–60	>20	0.02–0.04	5.6–7.3	<2
Synarep:					
172	0–46	0.6–2.0	0.19–0.21	7.9–8.4	<2
	46–60	2.0–6.0	0.11–0.15	7.4–7.8	<2
Tonasket:					
173, 174, 175, 176, 177	0–28	0.6–2.0	0.19–0.21	6.6–7.8	<2
	28–65	0.2–0.6	0.16–0.18	7.9–9.0	<4
178	0–8	0.6–2.0	0.16–0.19	6.6–7.8	<2
	8–28	0.6–2.0	0.16–0.18	6.6–7.8	<2
	28–65	0.2–0.6	0.16–0.18	7.9–9.0	<4
Wadams:					
179	0–4	2.0–6.0	0.12–0.15	6.6–7.3	<2
	4–31	2.0–6.0	0.10–0.12	6.6–7.3	<2
	31–60	>20	0.05–0.07	6.6–7.3	<2
180, 181	0–4	2.0–6.0	0.10–0.12	6.6–7.3	<2
	4–31	2.0–6.0	0.10–0.12	6.6–7.3	<2
	31–60	>20	0.05–0.07	6.6–7.3	<2

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Low	0.28	2	4
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.28	2	----------
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.32	2	3
Low	Low	Low	0.28		
Low	Low	Low	0.10		
Low	Low	Low	0.28	2	4
Low	Low	Low	0.28		
Low	Low	Low	0.10		
Low	Low	Low	0.28	2	----------
Low	Low	Low	0.28		
Low	Low	Low	0.10		
Low	Low	Low	0.28	5	3
Low	Moderate	Low	0.20		
Low	Low	Low	0.28	5	----------
Low	Moderate	Low	0.20		
Low	Low	Low	0.32	5	5
Low	Moderate	Low	0.20		
Low	Low	Low	0.32	3	5
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.24	2	2
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.20	2	2
Low	Low	Low	0.20		
Low	Low	Low	0.10		
Low	Low	Low	0.20	2	3
Low	Low	Low	0.17		
Low	Low	Low	0.10		
Low	Low	Low	0.17	2	4
Low	Low	Low	0.17		
Low	Low	Low	0.10		
Low	High	Low	0.43	5	----------
Low	High	Low	0.24		
Low	High	Low	0.43	5	5
Low	High	Low	0.43		
Low	Moderate	Low	0.43	5	----------
Low	High	Low	0.43		
Low	High	Low	0.43		
Low	Low	Low	0.24	5	3
Low	Low	Low	0.24		
Low	Low	Low	0.17		
Low	Low	Low	0.20	5	----------
Low	Low	Low	0.17		
Low	Low	Low	0.17		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*
Winthrop:					
182	0–25	>20	0.05–0.07	6.6–7.3	<2
	25–60	>20	0.03–0.05	6.6–7.3	<2
183	0–13	>20	0.04–0.06	6.6–7.3	<2
	13–25	>20	0.05–0.07	6.6–7.3	<2
	25–60	>20	0.02–0.04	6.6–7.3	<2
Xerofluvents:					
184	0–60				

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 12 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation are also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Formation and Classification of Soils

This section explains how soil-forming factors have affected formation of the soils of the Okanogan County Area. It also explains the classification system and classifies the soils by higher categories.

Factors of Soil Formation

Soil is a natural body on the earth in which plants grow. It consists of organic and mineral material. Soils differ in their appearance, composition, productivity, and management requirements in different localities and within short distances in the same locality. The properties of the soil at any given place are determined by five factors: 1) the physical and mineralogical composition of the parent material; 2) the climate under which the soil material has accumulated and has existed since accumulation; 3) the plant and animal life on and in the soil; 4) the topography, or lay of the land; and 5) the length of time the forces of soil formation have acted on the soil material. These factors, as they occur in the Okanogan County Area, are described in the following paragraphs.

Parent material

Parent material is the weathered rock or unconsolidated material in which soils form. Most of the soils in the Area formed in materials derived mainly from volcanic ash and glaciation. There are six kinds of parent material in the Area: volcanic ash, glacial till, glacial lacustrine deposits, glacial outwash, weathered bedrock, and recent alluvium.

Recent geologic action has modified these basic soil materials. Wind has modified some of the parent material by sorting out and blowing away the finer

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Low	0.24	2	2
Low	Low	Low	0.10		
Low	Low	Low	0.20	2	
Low	Low	Low	0.24		
Low	Low	Low	0.10		

behavior of the whole mapping unit.

materials, and by piling up the remaining sandy material in dunes. This action is most apparent along the Columbia and Okanogan Rivers from Pateros to the Canadian border.

The ash from volcanic eruptions in the Cascade Mountains was carried and deposited by post-glacial winds over most of the Area. The Glacier Peak eruption in the northern Cascade Range of Washington has a radiocarbon age of 12,000±310 years, and the Mount Mazama eruption at Crater Lake, Oregon, has an age of about 6,600 years (*4*). In a transect eastward from Glacier Peak, the pumice and coarse ash appear to grade smoothly to the finer Mazama ash. These ash deposits are the most prominent east of the Okanogan River.

Glacier Peak ash is on the Great Terrace of the Okanogan and Columbia Rivers north of Brewster but not on the younger terraces in the Okanogan Valley. These terraces were in central parts of the valley still covered with ice at the time of the Glacier Peak eruption. The Wadams soil in the southwestern part of the Area is a probable example of the Glacier Peak ash influence.

Soils most influenced by Mazama ash are in the northern part of the Area, at elevations above 3,000 feet. Donavan, Havillah, Hum, Koepke, Mires, Molson, and Nevine soils are examples. The main importance of ash is its effect on soil texture. Ewall soils, for example, lack any trace of this airborne material and have a sandy texture. Soils with a large amount of ash, such as Hum and Molson soils, have a silt loam texture.

The Okanogan Lobe, the largest lobe of the Cordilleran Ice Sheet, covered most of the Okanogan County Area and pushed southward across the Columbia River into Douglas County. The ice was more than a mile deep in places, and only the highest mountain peaks, at elevations more than about 5,000 feet, were left uncovered. More than one advance of the ice sheet is known (*3*).

As the ice moved southward, materials formed by the grinding action at the base of the glacial ice resulted in a random mixture of glacial flour, sand, gravel, and stones. Formed in this type of parent material are the Conconully, Dinkelman, Donavan, Hum, Koepke, Molson, Nevine, Newbon, and Wadam soils. Some are mantled by volcanic ash.

As the ice melted, the main valleys now occupied by the Methow and Okanogan Rivers were temporarily dammed by ice, and glacial lakes formed. Nongravelly very fine sand, silt, and clay particles were deposited. Influenced by this action are the Disautel, Havillah, Hodgson, Hunters, Nespelem, Nighthawk, and Tonasket soils. Some have been influenced by the ash mantle.

As the ice receded northward, large streams of water flowed outward from the glacial front and carried large quantities of sand and gravel. The varying volume of water and rate of flow resulted in different degrees of the sorting of these materials. Thick beds were deposited in stream valleys and on terraces along valley sides. Formed in these materials are the Aeneas, Cashmere, Cashmont, Chesaw, Ewall, Haley, Karamin, Kartar, Leader, Merkel, Mires, Owhi, Pogue, Republic, Skaha, Springdale, and Winthrop soils. Ewall, Skaha, and Winthrop soils have been further modified by wind.

Soils formed in alluvial deposits along the Okanogan River are medium and coarse textured. The Boesel, Colville, Emdent, Leavenworth, Okanogan, and Synarep are alluvial soils.

Before the advent of the glaciers, the Area was covered mostly by Cretaceous sedimentary and Mesozoic granitic rock formations. As the glaciers receded, the rock outcrop exposed in many places formed a complex pattern with the materials deposited by glaciation. The exposed bedrock shows various degrees of weathering. Much of the bedrock is weathered to the extent that shallow soils have formed. An example is the Vallan silt loam, which is only 10 to 20 inches thick over bedrock. This soil is neutral to slightly acid and is 15 to 25 percent angular and rounded gravel.

Climate

The main climatic factors that influence soil formation are temperature, amount of precipitation, and seasonal distribution of precipitation. Climate affects the soil through its influence on weathering, leaching of carbonates, translocation of clay, reduction and trans-

TABLE 12.—*Soil and*

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Aeneas: 1, 2, 3	B	None		
Badland: 4				
Boesel: 5	B	Occasional	Brief	Jan-May
Boesel Variant: 6	C	Occasional	Brief	Jan-May
Cashmere: 7, 8, 9, 10, 11	B	None		
Cashmont: 12, 13, 14, 15, 16, 17, 18, 19, 20	B	None		
Chesaw: 21, 22	A	None		
Colville: 23	B/D	Common	Long	Jan-May
24	B	Common	Brief	Feb-May
Conconully: 25, 26, 27, 28, 29, 30, 31, 32	B	None		
Dinkelman: 33, 34, 35, 36, 37, 38	B	None		
Disautel: 39, 40, 41, 42, 43, 44	B	None		
Donavan: 45, 46, 47, 48, 49	B	None		
[1] 50:				
Donavan part	B	None		
Rock outcrop part				
Emdent: 51	C	Common	Brief	Jan-May
Ewall: 52, 53, 54, 55	A	None		
Haley: 56, 57, 58	B	None		
Havillah: 59, 60, 61, 62, 63	B	None		
Hodgson: 64	B	None		
Hum: 65	B	None		
Hunters: 66, 67, 68, 69	B	None		
Karamin: 70	B	None		
Kartar: 71, 72, 73, 74, 75	B	None		

water features

such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			>60		Moderate.
3.0–4.0	Apparent	Jan-Jun	>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Low.
0.0–4.0	Apparent	Jan-Jun	>60		High.
2.0–5.0	Apparent	Feb-Jun	>60		High.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
2.5–3.5	Apparent	Jan-Jun	>60		High.
>6.0			>60		Low.
>6.0			>60		Moderate.
>6.0			>60		High.
>6.0			>60		Moderate.
>6.0			>60		High.
>6.0			>60		High.
>6.0			>60		Moderate.
>6.0			>60		Moderate.

TABLE 12.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Koepke: 76, 77, 78, 79, 80	B	None		
Leader: 81, 82, 83	B	None		
Leavenworth: 84	B	Occasional	Brief	Nov-Jun
Lithic Xerochrepts: [1] 85:				
Lithic Xerochrepts part	D	None		
Cashmont part	B	None		
[1] 86:				
Lithic Xerochrepts part	D	None		
Conconully part	B	None		
[1] 87:				
Lithic Xerochrepts part	D	None		
Donavan part	B	None		
Rock outcrop part				
[1] 88:				
Lithic Xerochrepts part	D	None		
Hum part	B	None		
[1] 89:				
Lithic Xerochrepts part	D	None		
Kartar part	B	None		
[1] 90:				
Lithic Xerochrepts part	D	None		
Molson part	B	None		
[1] 91:				
Lithic Xerochrepts part	D	None		
Nevine part	B	None		
[1] 92:				
Lithic Xerochrepts part	D	None		
Newbon part	B	None		
[1] 93:				
Lithic Xerochrepts part	D	None		
Nighthawk part	B	None		
[1] 94:				
Lithic Xerochrepts part	D	None		
Republic part	B	None		
[1] 95:				
Lithic Xerochrepts part	D	None		
Vallan part	D	None		
[1] 96:				
Lithic Xerochrepts part	D	None		
Wadams part	B	None		
Marsh: 97				
Merkel: 98, 99, 100	B	None		
Mires: 101, 102, 103, 104	B	None		

water features—Continued

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			>60		High.
>6.0			>60		Moderate.
2.0–4.0	Apparent	Nov-Jun	>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		High.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		High.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			6–20	Hard	Moderate.
>6.0			5–20	Hard	Moderate.
>6.0			>60		High.
>6.0			>60		Moderate.
>6.0			>60		High.

TABLE 12.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Molson: 105, 106, 107, 108, 109, 110, 111	B	None		
Nespelem: 112, 113, 114, 115, 116	B	None		
117	C	None		
Nevine: 118, 119, 120, 121	B	None		
Newbon: 122, 123, 124, 125, 126, 127, 128, 129, 130	B	None		
Nighthawk: 131, 132, 133, 134, 135, 136	B	None		
Okanogan: 137, 138	B	Common	Long	Jan-May
Owhi: 139, 140, 141, 142, 143, 144	B	None		
Pogue: 145, 146, 147, 148, 149, 150, 151, 152	B	None		
Republic: 153, 154, 155, 156, 157, 158, 159, 160	B	None		
Riverwash: 161				
Rock outcrop: 162				
Skaha: 163, 164, 165, 166	A	None		
Springdale: 167, 168, 169, 170, 171	B	None		
Synarep: 172	B	Rare		
Tonasket: 173, 174, 175, 176, 177, 178	B	None		
Wadams: 179, 180, 181	B	None		
Winthrop: 182, 183	A	None		
Xerofluvents: 184	A	Common	Brief	Jan-Jun

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

fer of iron, and rate of erosion. Climate also determines, to a great extent, the kind and amount of vegetation produced and the rate of vegetation decomposition.

The annual precipitation in the Okanogan County Area ranges from 8 inches in the valley near Pateros to 22 inches on the mountain peaks. Precipitation is lowest in July and August. It gradually reaches a maximum in midwinter, decreases in spring, and increases slightly in May and June. Winter precipitation is mostly in the form of snow. Warm winds and rain often melt the snow rapidly. If the soil is frozen at

water features—Continued

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			>60		High.
>6.0			>60		High.
>6.0			>60		High.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Low.
>6.0			>60		Low.
3.0–4.0	Apparent	Jan-Jun	>60		High.
>6.0			>60		Moderate.
>6.0			>60		High.
>6.0			>60		Low.
1.5–3.0	Apparent	Jan-Jun	>60		

behavior of the whole mapping unit.

this time, much of the moisture is lost through runoff. The steeper the slope, the more the runoff. In the steeper areas, therefore, less water is available to contribute to the weathering and the leaching of the soil.

The average annual temperature at Omak, Washington, is about 49° F. The average temperature in January is about 24°. The soil is generally frozen for a short period in winter. The average temperature in July is about 72°. The average temperature becomes progressively lower as the elevation increases. In the western part of the survey area, near Winthrop, the

average annual temperature is about 45°. The average temperature in January is 18°, and the average temperature in July is 68°.

Most of the precipitation falls during the winter. The effectiveness of summer rainfall is negligible. Summer storms are intense and of short duration. Little water percolates into the soil. Low humidity and high temperature result in rapid evaporation. Consequently, the soils are mostly dry from the middle of July to late in October. During this period, chemical and biological activity is slower than it would be under higher rainfall and humidity. These dry conditions commonly prevail early in winter. Moisture and temperature condition late in spring are favorable for biological activity.

The dominant vegetation in the warm, dry areas is grass and shrubs. Organic matter accumulates in the surface layer, and calcium carbonate accumulates in the lower horizons. For example, Disautel soils, annual precipitation of 11 to 15 inches, have calcium carbonate leached to 24 inches and are dark grayish brown in the surface layer.

The dominant vegetation in cool moist areas is forest. Decomposing forest litter forms organic acids that are carried downward through the soil layers. The acids dissolve and translocate iron, aluminum, and carbonates to lower layers. For example, the Merkel and Nevine soils have a very thin, gray leached layer over a brown or pale brown layer of accumulated iron, humus, and aluminum. The carbonates in the Nevine soils are leached to a depth of 60 inches or more.

The more the precipitation, the more strongly leached the soils. The leaching is reflected not only in depth to carbonates but also in pH and base saturation. The Disautel and Conconully soils in areas of 11 to 15 inches precipitation range in pH from 6.6 to 9.0 and are 75 to 100 percent saturated with bases. The Merkel and Nevine soils in areas of 16 to 22 inches precipitation have pH from 6.1 to 7.8 and a base saturation of about 65 to 90 percent.

Living organisms

Plants, micro-organisms, earthworms, and other forms of life on or in the soil are active in soil forming processes. They provide organic matter, help to decompose plant residues, affect the chemistry of the soil, and hasten soil development. Living soil organisms also help to convert plant nutrients into a form that is available to higher plants. Some organisms retard horizon differentiation by churning or mixing the soil.

Vegetation has greatly influenced soil formation in the Okanogan County Area. Plants draw moisture and mineral nutrients from the soil, and root penetration greatly influences aeration and soil permeability. When the life cycle of a plant is complete, residues are returned to the soil to replenish the supply of organic matter. Different types of vegetation have different effects on soil development. Grasses contribute considerable quantities of organic material, in the form of vegetation and roots, which forms a thick dark colored A horizon. Conifer trees deposit large quantities of organic material, in the form of needles and wood, on the surface where it is decomposed by fungi and other soil organisms. Tree roots also contribute significant amounts of organic material to these soils. Although the amount of organic material returned to the soil under trees is commonly high in volume, the proportion and kind of organic material in the surface layer soil is usually not high enough to darken it appreciably. Vegetation protects the soil against loss of water through runoff. Plant roots keep the soil supplied with plant nutrients by recycling them from a lower depth to the surface.

The natural vegetation of the area varies greatly and is largely related to the climate.

Areas where annual precipitation is 8 to 11 inches have grassland vegetation. The vegetation on the droughty, coarse textured soils is varied but is mainly needleandthread, Indian ricegrass, Sandberg bluegrass, rabbitbrush, big sagebrush, and bitterbrush. On the moderately coarse textured soils it is mainly bluebunch wheatgrass, Sandberg bluegrass, needleandthread, balsamroot, and big sagebrush. The organic-matter content of the surface layer is 1 to 2 percent, and the surface layer is usually very dark grayish brown when moist.

In areas where the annual precipitation is 11 to 14 inches, the importance of Idaho fescue and bluebunch wheatgrass in the plant community increases. Associated vegetation is Columbia needlegrass, Sandberg bluegrass, balsamroot, bitterbrush, big sagebrush and threetip sagebrush. Areas of this plant community commonly have scattered ponderosa pine, and on favorable sites, such as north-facing slopes, there are fair stands of ponderosa pine. The organic-matter content of the surface layer in these areas is about 3 percent; the surface layer is thicker than that of soils where precipitation is 8 to 10 inches, and the color of the moist soil is very dark brown.

The density of the forest vegetation increases at elevations above 3,000 feet and the annual precipitation is greater than 14 inches. Open grassland areas at this elevation support bluebunch wheatgrass, Idaho fescue, rough fescue, Columbia needlegrass, lupine, threetip sagebrush, rose, snowberry, and cinquefoil. The soils have a thick, dark colored A horizon that is black when moist, and the organic-matter content is greater than 5 percent.

Ponderosa pine dominates in areas where the annual precipitation is 14 to 16 inches. Associated vegetation includes Douglas-fir, pinegrass, bluebunch wheatgrass, rough fescue, and Idaho fescue. The surface layer is generally very dark brown when moist.

Douglas-fir is dominant in areas where the annual precipitation is 16 to 18 inches or on favorable sites where it is 14 to 16 inches. Associated vegetation consists of larch, ponderosa pine, ninebark, pachistima, snowberry, and pinegrass. When moist, the soil is brown or dark brown, and the color brightens with increasing depth.

To a minor extent, pocket gophers and ground squirrels influence the formation of soils under grassland, and to a lesser extent, the soils under woodlands. Pocket gophers develop an extensive network of tunnels, mix the soil, and carry organic material from the surface to the lower layers.

Topography

Topography influences the soil forming processes by affecting runoff, drainage, and microclimate. In level areas, runoff is very slow. Much of the water drains through the soil, and some evaporates. In sloping to steep areas, runoff generally increases with increasing slope. The more water that enters the soil, the greater the depth to which the soil is leached and weathered.

The Okanogan County Area has two long narrow valleys, the Methow and the Okanogan. Elevation at the junction of the Columbia River and the Methow River is about 750 feet and about 1,800 feet at the upper boundary of the Area on the Methow River. Elevation is about 800 feet at the junction of the Columbia River and the Okanogan River and about 1,050 feet near the Canadian border at Lake Osoyoos.

The valley sides rise rapidly in a series of terraces with steep ridges and uplands bordering both sides of the valley. Between the valleys are broad rolling till plains. The Sinlahekin Valley at Loomis is similar, but the change from valley terraces to steep upland ridges is more abrupt. Elevations in the valley are 1,150 to 1,310 feet. The valley from Nighthawk to the Canadian border is similar to the Sinlahekin Valley, but west of Nighthawk the Similakameen River cuts through rough, steep, broken land.

Soils of similar parent material may differ because of the influence of topography. For example, the Donavan soils, which have an A horizon about 7 inches thick, generally occupy convex slopes and receive less effective moisture than Koepke soils. Koepke soils, which have an A horizon about 35 inches thick, occupy north-facing foot slopes and concave slopes.

The topography, through variations in exposure to the sun and wind and air drainage, creates noticeable differences in vegetation and soil properties within short distances. For example, south-facing slopes receive more direct radiation from the sun than do the north-facing slopes. Consequently, south-facing slopes are warmer and drier. The mean annual soil temperature at a depth of 20 inches on a north exposure is about 6° cooler than the opposite south exposure.

Time

The length of time required for the formation of a given kind of soil depends largely on the other factors of soil formation. An estimate of the age or maturity of a soil is based on the kinds, the thickness, and the arrangement of genetic horizons. Generally, the greater the number of genetic horizons, the more mature the soil. Most of the soils of the Okanogan County Area have minimal horizon formation. The length of time that soil-forming factors have been active has allowed only for accumulation of organic matter and some translocation of carbonates, iron and aluminum, and small amounts of clay.

For the most part, soil-forming factors have been acting on the parent material since the last glaciation about 9,000 years ago. Since the last glaciation, however, there has been several volcanic ash falls.

Soils of the bottom lands along streams and rivers periodically receive deposits of fresh material. Consequently, these soils are younger, and if well drained, they have no perceptible horizons other than an A horizon or a C horizon. Xerofluvents, wet, for example, commonly is stratified, varies in texture, and has no evidence of soil development because the soil material has not been in place long enough.

Skaha soils, which formed in gravelly outwash material on terraces, have an A horizon of organic accumulation but no B horizon. Though this soil is considerably older than Typic Xerofluvents, it is a relatively young soil because its characteristics are still mainly those inherited from the parent material.

Havillah soils are examples in which the influence of time on glacial deposits and recent volcanic ash is apparent. These soils have a thick dark colored A horizon and a fairly distinct B horizon. Lime has moved downward and has accumulated in horizons in the lower part of the profile.

Classification of the Soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 13, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol.* An example is Mollisols.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Xerolls.

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haploxerolls.

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate

TABLE 13.—*Classification of the soils*

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Aeneas	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Haploxerolls
Boesel	Coarse-loamy over sandy or sandy-skeletal, mixed, frigid Fluventic Haploxerolls
Boesel Variant	Fine-loamy, mixed, frigid Fluventic Haploxerolls
Cashmere	Coarse-loamy, mixed, mesic Aridic Haploxerolls
Cashmont	Coarse-loamy, mixed, mesic Aridic Haploxerolls
Chesaw	Sandy-skeletal, mixed, frigid Entic Haploxerolls
Colville	Fine-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Conconully	Coarse-loamy, mixed, mesic Typic Haploxerolls
*Dinkelman	Coarse-loamy, mixed, frigid Typic Haploxerolls
Disautel	Coarse-loamy, mixed, mesic Calcic Haploxerolls
Donavan	Medial over loamy, mixed, frigid Mollic Vitrandepts
*Emdent	Medial, calcareous, mesic Aeric Mollic Andaquepts
Ewall	Mixed, mesic Typic Xeropsamments
Haley	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haploxerolls
Havillah	Medial over loamy, mixed, frigid Mollic Vitrandepts
*Hodgson	Fine, mixed, mesic Typic Haploxeralfs
Hum	Medial over loamy, mixed, frigid Mollic Vitrandepts
Hunters	Fine-silty, mixed, frigid Calcic Haploxerolls
Karamin	Coarse-loamy over sandy or sandy-skeletal, mixed, frigid Typic Xerochrepts
Kartar	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Xerochrepts
*Koepke	Medial over loamy, mixed, frigid Mollic Vitrandepts
Leader	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Xerochrepts
*Leavenworth	Coarse-loamy, mixed, mesic Cumulic Haploxerolls
Lithic Xerochrepts	Lithic Xerochrepts
Merkel	Loamy-skeletal, mixed, frigid Typic Xerochrepts
Mires	Medial over sandy or sandy-skeletal, mixed, frigid Mollic Vitrandepts
Molson	Medial over loamy, mixed, frigid Mollic Vitrandepts
Nespelem	Coarse-silty, mixed, mesic Calcic Haploxerolls
*Nevine	Loamy-skeletal, mixed, frigid Andic Xerochrepts
Newbon	Coarse-loamy, mixed, mesic Typic Haploxerolls
Nighthawk	Loamy-skeletal, mixed, mesic Calciorthidic Haploxerolls
Okanogan	Coarse-loamy, mixed, mesic Fluventic Haploxerolls
Owhi	Coarse-loamy, mixed, mesic Typic Haploxerolls
Pogue	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Haploxerolls
Republic	Coarse-loamy, mixed, frigid Typic Haploxerolls
Skaha	Sandy-skeletal, mixed, mesic Xeric Torriorthents
Springdale	Sandy-skeletal, mixed, mesic Entic Ultic Haploxerolls
Synarep	Medial, mesic Typic Vitrandepts
Tonasket	Coarse-loamy, mixed, mesic Calciorthidic Haploxerolls
Vallan	Loamy, mixed, frigid Lithic Xerochrepts
Wadams	Medial over sandy or sandy-skeletal, mixed, mesic Typic Vitrandepts
Winthrop	Sandy-skeletal, mixed, mesic Entic Haploxerolls
Xerofluvents	Xerofluvents

transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haploxerolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-loamy, mixed, mesic, Typic Haploxerolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Four soil orders are represented in the Okanogan County Area, table 13: Alfisols, Mollisols, Inceptisols, and Entisols. They are discussed in the following paragraphs.

Alfisols

The only Alfisol in the area is in the Xeralf suborder. This soil formed in a subhumid climate. Winters are cold and moist, and summers are warm and dry.

Xeralfs are mainly moist but are dry in all parts between 4 and 12 inches for more than 60 consecutive days. The natural vegetation is commonly grasses and can include some trees and shrubs. Typically, these soils have an A horizon that is friable when moist, is generally massive and hard when dry, and is low in

organic matter. This horizon overlies a pale or dull, clay enriched B horizon. The boundary between the A and B horizon is abrupt. The B horizon has a finer texture. It has base saturation that is medium to high, or greater than 35 percent. The pH values and base saturation are fairly uniform, or they increase with depth.

Haploxeralfs.—Xeralfs that have a clay enriched B horizon of any texture and a clear to gradual boundary between the A and B horizons are classified in the Haploxeralf great group.

Typic Haploxeralfs are Haploxeralfs that have a pale A horizon low in organic matter and a slight to moderate clay enriched B horizon. The B horizon has more than 75 percent base saturation. The soils in this subgroup are moderately well drained to somewhat excessively drained.

The Hodgson series is classified in this subgroup. The argillic, or B, horizon is 35 to 40 percent clay by weighed average. The Hodgson soil in the Okanogan County Area is moderately well drained.

Mollisols

The Mollisols in the survey area are in the Xeroll and Aquoll suborders.

The *Xeroll* subgroup consists of soils that formed in a cold, subhumid climate or in a semiarid climate. Winters are cold and moist, and summers are warm and dry. Unless irrigated, these soils are dry throughout the moisture control zone for more than 60 consecutive days during the 3 month period following the summer solstice. The natural vegetation is grasses, trees, and shrubs. The soils typically have a dark colored surface layer that is more than 7 inches thick and is more than 1 percent organic matter. Base saturation of this layer is more than 50 percent.

Xerolls are on till plains, in lacustrine basins, and on outwash terraces. They vary in thickness of the dark surface layer, texture and depth of underlying material, flood hazard, and calcium carbonate content.

Aquolls are similar to Xerolls but are seasonally wet or have characteristics associated with poor drainage. They are on bottom land adjacent to rivers that overflow.

Haploxerolls.—The soils in this great group of Xerolls lack a clay enriched B horizon and have a mollic epipedon.

Typic Haploxerolls are Haploxerolls that formed under good drainage and do not have bedrock within a depth of 20 inches. They have more than 75 percent base saturation in the upper 30 inches of the profile, and the organic matter content decreases regularly with depth. The B horizon lacks clay enrichment, and the dark colored surface layer is less than 20 inches thick.

There are six series in this subgroup. Conconully, Haley, Newbon, and Owhi soils have mesic soil temperature regimes and are well drained or somewhat excessively drained. Dinkelman and Republic soils have frigid soil temperature regimes and are well drained. Parent material and climate are important factors in the development of these soils.

Entic Haploxerolls are Haploxerolls that formed under excessive drainage. They are similar to the Typic Haploxerolls but lack a B horizon.

Chesaw and Winthrop are the series classified in this subgroup. These soils formed on eskers and outwash plains under grassland-brush vegetation and in well sorted outwash materials. Winthrop soils are mesic, and Chesaw soils are frigid.

Cumulic Haploxerolls have a dark colored surface layer thicker than 20 inches, lack a B horizon, and decrease irregularly in organic matter content with increasing depth.

The Leavenworth series is classified in this subgroup. Leavenworth soils are well drained or moderately well drained. They are on bottom land. Time and climate are important factors influencing the characteristics of these soils.

Fluventic Haploxerolls differ from the Typic Haploxerolls in having a dark colored surface layer less than 20 inches thick and an irregular decrease in organic matter content with depth.

The Boesel and Okanogan series are in this subgroup. These soils are in recent alluvial bottoms along perennial streams that overflow. Boesel soils are frigid, and Okanogan soils are mesic. Climate, parent material, and time are the important factors influencing the profile characteristics.

Entic Ultic Haploxerolls formed under somewhat excessive drainage. They are similar to the Typic Haploxerolls but lack a B horizon and have less than 75 percent base saturation in the upper 30 inches of the profile.

Springdale is the only series in this subgroup. These soils formed on outwash terraces under ponderosa pine and a grass understory. Parent material, climate, and time are important factors influencing the profile characteristics.

Aridic Haploxerolls formed under the same conditions that developed all the characteristics of the Haploxerolls, but lack sufficient annual precipitation for a Xeric moisture regime.

The series in this subgroup are Aeneas, Cashmere, Cashmont, and Pogue. These soils developed under somewhat excessive to good drainage and under grassland vegetation. They are on terraces and till plains. Winter precipitation is sufficient for vegetation to maintain the organic matter content and to darken the surface layer enough so that it barely meets the requirements of a mollic epipedon.

Calciorthidic Haploxerolls are well drained soils that are similar to the Typic Haploxerolls but have a calcic horizon within a depth of 60 inches and lack sufficient annual precipitation for a Xeric moisture regime.

The Tonasket and Nighthawk series are in this subgroup. These soils developed in calcareous till and lacustrine sediments on nearly level to steep terraces and till plains. Parent material and climate are the principal factors influencing the profile characteristics.

Calcic Haploxerolls formed under good drainage. They are similar to the Typic Haploxerolls but have a calcic horizon within a depth of 60 inches.

The series in this subgroup are Disautel, Hunters, and Nespelem. These soils developed in calcareous till and lacustrine sediments on dissected terraces and till plains. Parent material and climate are the principal factors influencing the profile characteristics.

Haplaquolls.—The soils in this great group of

Aquolls lack a duripan or calcic horizon within the upper 16 inches and have no clay enriched B horizon.

Fluvaquentic Haplaquolls have an irregular decrease in organic carbon with increasing depth. This decrease is caused by the accumulation of fresh sediments during flooding.

These soils formed under poor drainage on bottom land adjacent to rivers that overflow annually. Relief, as it affects drainage and interception of flooding or runoff, is a major factor in the profile characteristics.

Inceptisols

The Inceptisols in this survey area are in the Ochrept, Andept, and Aquept suborders.

Ochrepts formed in a cool subhumid climate. Winters are cold and moist, and summers are warm and dry. The natural vegetation is mainly coniferous trees and a grass and shrub understory. The soils typically are never saturated with water and have a pale colored A horizon that is very friable when moist and soft when dry. The A horizon is low in organic matter content or is too thin to be mollic. The color of the B horizon increases in value and chroma. The B horizon has no accumulations of clay. Ochrepts are in large areas on the till plains above elevations of 1,500 feet.

Andepts have either low bulk density or more than 60 percent pyroclastic materials, or both. They formed in a cool subhumid climate. Winters are cold and moist, and summers are warm and dry. The natural vegetation is mainly grasses and shrubs and trees on north-facing slopes. The surface horizon is very friable when moist and soft when dry and is high in organic matter content. The B horizon has no accumulation of clay. Andepts are in large areas on the till plains at elevations of 3,000 feet.

Aquepts are similar to Andepts in profile development but are sometimes saturated with water during the year. They are on alluvial bottoms and have a water source throughout the year.

Xerochrepts.—The soils in this great group of Ochrepts have a Xeric moisture regime but do not have a fragipan or a duripan within 40 inches of the soil surface.

Typic Xerochrepts are well drained or somewhat excessively drained soils. The A horizon is light colored, or it is less than 6 inches thick. When mixed to a depth of 7 inches, the A horizon is less than 1 percent organic matter. The organic matter content decreases with depth. These soils lack a calcic horizon or soft powdery lime accumulations within 60 inches of the soil surface. They have a base saturation, however, of at least 60 percent in some part of the profile between a depth of 10 to 30 inches. They are not fine textured and do not have hard unweathered rock within a depth of 20 inches.

The Karamin, Kartar, Leader, and Merkel series are in this subgroup. These soils are moderately coarse textured. They formed in glacial outwash material on terraces and reworked till plains. Climate and vegetation are the principal factors influencing the characteristics of these soils.

Andic Xerochrepts have surface horizons 7 inches or more thick, influenced by pyroclastic material.

Donavan and Nevine series are in this subgroup. These well drained soils formed in a mantle of ash and underlying glacial till on gently sloping to very steep mountainous uplands. Parent material and vegetation are major factors influencing the characteristics of these soils.

Lithic Xerochrepts have a shallow lithic contact.

Vitrandepts.—The soils in this great group of Andepts are dominated by volcanic ash and have low amounts of weathered clays. They feel like sandy loam or loamy sand and commonly seem to be gravelly. They have unusually high moisture retention qualities and their base saturation is variable. They do not have indurated layers within 40 inches of the soil surface.

Typic Vitrandepts are well drained or moderately well drained, pale colored soils that formed in thick or moderately thick volcanic ash deposits. The deposits are geologically recent and only slightly weathered.

The Synarep series is in this subgroup. These soils formed under moderately well drained conditions in volcanic ash deposits on alluvial bottoms and in depressions. Relief, time, and climate are the major factors influencing the characteristics of these soils.

Mollic Vitrandepts are well drained soils that are similar to the Typic Vitrandepts but differ in having a mollic epipedon. The base saturation is high.

Havillah, Hum, Koepke, Mires, Molson, and Wadams series are in this subgroup. These soils formed in a volcanic ash mantle and the underlying glacial till and glacial outwash material. They are on till plains and outwash terraces at elevations above 3,000 feet. Parent material, climate, and vegetation are major factors influencing the characteristics of these soils.

Andaquepts.—The soils in this great group of Aquepts formed mostly in volcanic material or have an exchange complex dominated by amorphous materials. They have a low bulk density, and in this Area all have a mollic epipedon.

Typic Andaquepts have dull gray colors and an umbric epipedon. The supply of bases in the epipedon is low and is generally low throughout the profile. No series represented in the Okanogan County Area is classified in this subgroup.

Mollic Andaquepts, like the typic subgroup, have a dark colored mollic epipedon more than 15 inches thick and have high base saturation throughout.

Emdent is the only series classified as a Mollic Andaquept. These poorly drained soils formed in alluvium dominated by volcanic ash adjacent to streams. Relief, as reflected in drainage, and parent material are the major factors influencing the characteristics of these soils.

Entisols

The Entisols in this survey area are in the Orthent, Psamment, and Fluvent suborders. These soils, for the most part, formed under a warm semiarid climate with cold, moist winters and hot, dry summers. They lack diagnostic horizons and generally have a low content of organic matter. Unless irrigated, the soils in these suborders are dry throughout the moisture control zone for more than 60 consecutive days following the summer solstice. They are mostly well drained and are seldom saturated with water for long periods. The natural vegetation is commonly grasses, shrubs, and scattered trees.

The *Orthents* in Okanogan County are coarser than loamy very fine sand and are more than 35 percent coarse fragments within 40 inches of the surface. They are dominant along low terraces adjacent to the main streams.

Fluvents are loamy fine sand or finer in texture. They formed in recent alluvium along the streams. The organic matter content decreases irregularly with depth.

Psamments are sandy soils with a texture of loamy fine sand or coarser in all parts of the profile to a depth of 40 inches or more. They are along low terraces adjacent to the main streams.

Torriorthents.—The soils in this great group of Orthents are dry. They have aridic moisture regimes or are salty, or both. They are neutral or calcareous.

Typic Torriorthents are pale colored soils that are low in organic matter content. Unless irrigated, they are dry in the moisture control zone three-fourths of the time the soil temperature is above 41° F. They are not saturated with water within 5 feet at any time of the year. They do not have cemented layers within a depth of 40 inches or hard rock within a depth of 20 inches.

Skaha is the only series classified as a Typic Torriorthent. These soils formed on gravelly glacial outwash terraces and are modified by wind. They are at elevations of 700 to 1,500 feet. Climate, time, and parent material are the major factors influencing the soil characteristics.

Xeropsamments.—The soils in this great group of Psamments are dry in summer and are moist in the moisture control section late in winter and in spring for more than 90 days.

Typic Xeropsamments are deep, pale colored sandy soils that are excessively drained. They are low in organic matter content. They do not have cemented layers or durinodes within 40 inches or bedrock within a depth of 5 feet.

Ewall is the only series in this subgroup. These soils formed in glacial outwash terraces along the major streams in the Area. They have been modified by wind. They are at elevations of 700 to 1,500 feet. Climate, parent material, and time are the major factors influencing the characteristics of these soils.

Xerofluvents.—The soils in this great group of Fluvents are dry in summer and are moist in the moisture control section late in winter and in spring for more than 90 days.

Typic Xerofluvents are subject to frequent flooding during spring and early summer runoff. They are not saturated with water when the rivers and streams are at low flow late in summer and in fall. Xerofluvents, wet, are like Typic Xerofluvents but are saturated within 1½ to 3 feet of the surface at some time during most years.

Climate[7]

The climate of Okanogan County Area is influenced by topography, prevailing westerly winds above the crest of the Cascade Mountains, the paths of storm systems crossing the North Pacific, cold air masses moving southward from the Arctic region, and the distance and direction from the ocean. The Cascade Range forms a barrier to the easterly movement of comparatively mild moist air in winter and cool air in summer. The Rocky Mountains and other ranges in southern British Columbia protect this area from the more intense winter storms moving southward across Canada. Some of the air from each of these source regions, however, reaches the Area. The climate, therefore, is continental and marine.

Summers are warm, dry, and sunny. During the warmest months, afternoon temperatures are in the upper 80s, and nighttime temperatures drop to nearly 50° very quickly after sunset. Maximum temperatures in the valleys exceed 90° on about one-third to one-half the days in midsummer and occasionally reach 100°. The combination of dry air, clear skies, and cool breezes in late afternoon results in pleasant nighttime temperatures. A difference of several days in the length of the growing season can be expected within distances of a few miles. Occasional outbreaks of cold air in late spring or early fall have caused extensive damage to fruit and other crops.

The average growing season at Brewster is near 180 days, but in parts of the mountains it is as low as 90 days. From Okanogan to Oroville in the Okanogan Valley the growing season is about 150 days to 160 days. In the Molson-Chesaw areas it is close to 100 days. Thunderstorms occasionally develop over the mountains and move across the lower valleys. A few damaging hailstorms occur in the farming areas of the valley each summer, and several forest and range fires are started by lightning.

Winters are cold and cloudy with some fog. The average afternoon temperature in the valleys in the coldest months is near or slightly above freezing. Nighttime temperatures range from 8° to 25° above zero. Cold snaps are not unusual, but they are generally short. In the mountains, temperatures decrease approximately 3° with each 1,000 feet increase in elevation.

Precipitation is light in summer, increases in fall, and peaks in winter. It decreases in spring, increases in May and June, and drops sharply about the first of July. Annual precipitation ranges from about 9 inches near Pateros to 22 inches in the mountainous areas. Summer precipitation frequently occurs as showers, and several thunderstorms can be expected. The more intense thunderstorms generally develop over the mountains.

Most of the winter precipitation occurs as snow, but it can fall as snow or rain. Snow can be expected after the first of December, and it remains on the ground from 4 to 10 weeks during the period December to March. During an average winter, snow in the valley accumulates to a depth of 10 to 30 inches. The amount and depth of snow increases rapidly with the rise in elevation along hillsides and mountainsides.

Tables 14 and 15 summarize climatic data recorded at several locations in the Okanogan County Area. The Oroville and Winthrop stations summarize data for the period 1931–1960, and the Omak station for the period 1930–1959.

[7] For more information refer to Climatological Summaries, U.S. Department of Commerce, Weather Bureau, in cooperation with the Washington State Department of Commerce and Economic Development.

TABLE 14.—*Probability of freezing temperatures*

Station	Temp. °F.	Probability in spring				Probability in fall			
		75%	50%	25%	10%	10%	25%	50%	75%
Omak	32	Apr. 27	May 11	May 25	June 5	Sept. 6	Sept. 17	Sept. 29	Oct. 11
	28	Apr. 3	Apr. 16	Apr. 29	May 11	Sept. 19	Sept. 30	Oct. 12	Oct. 24
	24	Mar. 20	Apr. 2	Apr. 16	Apr. 27	Oct. 5	Oct. 16	Oct. 28	Nov. 9
	20	Feb. 26	Mar. 12	Mar. 26	Apr. 6	Oct. 16	Oct. 27	Nov. 8	Nov. 20
	16	Feb. 10	Feb. 23	Mar. 10	Mar. 21	Nov. 3	Nov. 14	Nov. 26	Dec. 8
Oroville	32	Apr. 15	Apr. 29	May 13	May 24	Sept. 16	Sept. 27	Oct. 9	Oct. 21
	28	Mar. 24	Apr. 6	Apr. 20	May 1	Oct. 1	Oct. 12	Oct. 24	Nov. 5
	24	Mar. 6	Mar. 20	Apr. 3	Apr. 14	Oct. 21	Nov. 1	Nov. 13	Nov. 25
	20	Feb. 16	Mar. 1	Mar. 14	Mar. 27	Nov. 5	Nov. 16	Nov. 28	Dec. 11
	16	Feb. 1	Feb. 14	Feb. 28	Mar. 12	Nov. 13	Nov. 25	Dec. 7	Dec. 20
Winthrop	32	May 5	May 18	June 1	June 12	Aug. 31	Sept. 11	Sept. 23	Oct. 5
	28	Apr. 17	May 1	May 15	May 27	Sept. 11	Sept. 22	Oct. 4	Oct. 16
	24	Mar. 22	Apr. 5	Apr. 18	Apr. 30	Sept. 27	Oct. 8	Oct. 20	Nov. 1
	20	Mar. 10	Mar. 24	Apr. 7	Apr. 19	Oct. 8	Oct. 19	Oct. 31	Nov. 12
	16	Feb. 26	Mar. 12	Mar. 25	Apr. 6	Oct. 28	Nov. 8	Nov. 20	Dec. 2

Water Resources

The Okanogan County Area depends highly on its water resources for much of its economic stability. The valley bottoms and lower terraces, formed from alluvial or glacial deposits, are well suited to irrigation.

The Okanogan, Similakameen, and Methow Rivers contribute most of the water within the Area. Lesser streams and tributaries that originate within the Area are important in irrigating local areas. Discharge generated within the Area is mainly spring runoff caused by snow melt.

Impoundments in the Area having a total capacity of 5,500 acre feet or more are Conconully or Salmon Creek and Conconully Lake, off stream from the North Fork of Salmon Creek. Smaller impoundments for irrigation storage are Leader Lake, Duck Lake, Proctor Lake, Spectacle Lake, and Whitestone Lake. Numerous other lakes are within the Area but have not been developed for irrigating.

Availability of ground water within the Area varies. The valley aquifers of alluvial and glaciofluvial deposits of Quaternary age yield moderate to large supplies, 100 to 2,000 gallons per minute. The dissolved solids in this water are less than 400 milligrams per liter, and there are no excessive constituents.

Most of the Area has aquifers of consolidated sedimentary, igneous, and metamorphic rocks of Pretertiary age. The acquifers generally yield small supplies of water. A few wells produce a moderate supply. The amount of dissolved, soft to moderately hard solids in these waters is generally low.

Literature Cited

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Flint, R. F. 1947. Glacial geology and the Pleistocene Epoch.

(4) Fryxell, Ronald. Mazama and glacial peak volcanic ash layer: Relative ages. Science vol. 147, pp. 1288–1290.

(5) Meyer, W. H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Dep. Agric. Tech. Bull. 630, 59 pp., illus.

(6) Portland Cement Association. 1973. PCA soil primer. 39 pp., illus.

(7) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173–188 issued May 1962]

(8) United States Department of Agriculture. 1975. Soil Taxonomy. A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Ash, volcanic. Consists of small particles of solid or porous fragments of obsidian or pumice, which looks like coarse ashes, ejected in volcanic activity.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Low	Less than 3.75
Moderate	3.75–5.0
Moderately high	5.0–7.5
High	More than 7.5

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate

TABLE 15.—*Temperature and precipitation data*

Omak (latitude 48°25′; longitude 119°30′; elevation 850 feet)

Month	Temperature			Precipitation			Mean number of days		
								Temperature	
	Average daily maximum	Average daily minimum	Average	Average total	Average snowfall	Maximum snowfall	Precip. .10 in. or more	Maximum 90 and above	Minimum 32 and below
	°F	°F	°F	In	In	In		°F	°F
January	30	17	24	1.4	7.8	21.5	5	0	29
February	37	21	29	1.2	7.7	20.0	4	0	25
March	52	29	40	.9	.7	6.0	3	0	22
April	65	36	51	.9	(1)	.5	2	(2)	10
May	74	44	59	.9			3	2	2
June	80	50	65	1.5			4	4	(2)
July	88	55	72	.4			1	14	0
August	86	53	70	.4			1	11	0
September	77	45	61	.6			2	2	2
October	62	36	49	1.0	(1)	2.0	3	0	10
November	43	27	35	1.4	2.6	12.2	5	0	22
December	34	22	28	1.6	9.2	36.3	6	0	28
ANNUAL	61	36	49	12.2	28.0		39	33	150
Oroville (latitude 48°55′; longitude 119°26′; elevation 920 feet)									
January	32	20	26	1.2	8.8	33.8	4	0	28
February	38	23	31	.9	5.9	22.5	3	0	24
March	51	31	41	.8	1.3	15.0	3	0	19
April	64	38	52	.8	(1)	1.0	2	(2)	5
May	74	45	59	1.0			3	2	1
June	79	51	65	1.5			4	4	0
July	88	56	72	.6			2	14	0
August	86	55	70	.7			2	11	0
September	77	48	62	.6			2	2	(2)
October	62	39	50	1.0			3	0	5
November	44	30	37	1.4	2.1	15.0	5	0	18
December	36	25	31	1.3	6.5	18.2	5	0	25
ANNUAL	61	38	50	11.8	24.6		38	33	125
Winthrop (latitude 48°28′; longitude 120°11′; elevation 1,755 feet)									
January	28	9	18	2.0	23.8	61.0	6	0	31
February	36	13	24	1.6	15.1	39.8	5	0	28
March	48	23	35	.9	4.8	25.1	3	0	28
April	62	32	47	.7	.3	4.5	2	0	16
May	71	39	55	1.0			3	1	5
June	77	46	61	1.2			3	2	(2)
July	86	50	68	.5			1	11	0
August	85	48	66	.5			1	9	0
September	76	41	59	.7			2	2	3
October	62	33	47	1.0	1.0	7.5	3	0	0
November	42	23	33	1.9	12.3	38.7	6	0	27
December	31	15	23	2.5	24.4	67.0	7	0	31
ANNUAL	59	31	45	14.5	81.7		42	25	185

[1] Trace, an amount too small to measure.
[2] Less than one half.

(commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Crop rotation. The growing of different crops in recurring succession on the same field.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth, soil. Refers to the depth that plant roots use the soil, depth to bedrock, or other restricting layers or horizons such as indurated hardpans, fragipans, etc. Depth adjectives are:

Very shallow	less than 10 inches
Shallow	10 to 20 inches
Moderately deep	20 to 40 inches
Deep	40 inches or more

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Erosion hazard. Susceptibility to wind or water erosion. The terms used in this survey are slight, moderate, high, and very high. These terms are relative and apply only in relation to other soils of the Okanogan County Area.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have

formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Low strength. Inadequate strength for supporting loads.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Volcanic ash. See Ash, volcanic.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
1	Aeneas fine sandy loam, 0 to 3 percent slopes	8	IVe-3	52	IIe-1	54	2	3	61	--
2	Aeneas fine sandy loam, 3 to 8 percent slopes	8	IVe-3	52	IIIe-1	54	2	3	61	--
3	Aeneas fine sandy loam, 8 to 15 percent slopes	8	IVe-3	52	IVe-1	55	2	3	61	--
4	Badland	8	VIIIe-1	54	------	--	--	--	--	--
5	Boesel fine sandy loam	11	IIIw-1	52	IIIw-1	55	--	--	--	2o
6	Boesel silt loam, heavy subsoil variant	12	IIIw-1	52	IIIw-1	55	7	--	--	2o
7	Cashmere fine sandy loam, 0 to 3 percent slopes	13	IIIe-2	52	IIe-1	54	1	3	61	--
8	Cashmere fine sandy loam, 3 to 8 percent slopes	13	IIIe-2	52	IIIe-1	54	1	3	61	--
9	Cashmere fine sandy loam, 8 to 15 percent slopes	13	IIIe-2	52	IVe-1	55	1	3	61	--
10	Cashmere fine sandy loam, 15 to 25 percent slopes	14	IVe-3	52	VIe-1	55	1	3	61	--
11	Cashmere fine sandy loam, 25 to 65 percent slopes	14	VIIe-1	53	------	--	--	3	61	--
12	Cashmont sandy loam, 0 to 3 percent slopes	14	IVe-3	52	IIe-1	54	1	3	61	--
13	Cashmont sandy loam, 3 to 8 percent slopes	14	IVe-3	52	IIIe-1	54	1	3	61	--
14	Cashmont sandy loam, 8 to 15 percent slopes	14	IVe-3	52	IVe-1	55	1	3	61	--
15	Cashmont sandy loam, 15 to 25 percent slopes	14	IVe-3	52	VIe-1	55	1	3	61	--
16	Cashmont gravelly sandy loam, 0 to 8 percent slopes	15	VIe-2	53	IIIe-1	54	1	3	61	--
17	Cashmont gravelly sandy loam, 8 to 15 percent slopes	15	VIe-2	53	IVe-1	55	1	3	61	--
18	Cashmont very gravelly sandy loam, 3 to 25 percent slopes	15	VIe-2	53	------	--	--	3	61	--
19	Cashmont extremely stony sandy loam, 0 to 25 percent slopes	15	VIs-3	53	VIs-1	55	6	3	61	--
20	Cashmont extremely stony sandy loam, 25 to 45 percent slopes	15	VIIs-1	53	------	--	--	3	61	--
21	Chesaw gravelly sandy loam, 15 to 45 percent slopes	15	VIe-2	53	------	--	--	7	62	--
22	Chesaw extremely stony sandy loam, 15 to 45 percent slopes	16	VIIs-1	53	------	--	--	7	62	--
23	Colville silt loam	16	IVw-1	52	IVw-1	55	--	--	--	2w
24	Colville silt loam, moderately wet	16	IIIw-1	52	IIIw-1	55	--	2	60	--
25	Conconully gravelly sandy loam, 3 to 8 percent slopes	17	IVe-3	52	IVe-1	55	4	5	61	5o
26	Conconully gravelly sandy loam, 8 to 25 percent slopes	17	IVe-3	52	IVe-1	55	4	5	61	5o
27	Conconully loam, 0 to 8 percent slopes	17	IIIe-2	52	IIIe-1	54	4	5	61	5o

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
28	Conconully loam, 8 to 15 percent slopes	17	IIIe-2	52	IVe-1	55	4	5	61	5o
29	Conconully loam, 15 to 25 percent slopes	18	IVe-3	52	------	--	--	5	61	5o
30	Conconully extremely stony loam, 0 to 25 percent slopes	18	VIs-3	53	------	--	--	4	61	--
31	Conconully extremely stony loam, 25 to 65 percent slopes	18	VIIs-1	53	------	--	--	4	61	--
32	Conconully extremely stony loam, 25 to 65 percent north slopes	18	VIIs-1	53	------	--	--	5	61	5x
33	Dinkelman sandy loam, 0 to 25 percent slopes	18	IVe-2	52	------	--	--	--	--	5o
34	Dinkelman sandy loam, 25 to 65 percent slopes	19	VIe-1	53	------	--	--	--	--	5r
35	Dinkelman gravelly sandy loam, 3 to 25 percent slopes	19	IVe-2	52	IVe-1	55	7	--	--	5o
36	Dinkelman extremely stony sandy loam, 0 to 25 percent slopes	19	VIs-1	53	------	--	--	--	--	5x
37	Dinkelman extremely stony loam, 25 to 65 percent slopes	19	VIIs-1	53	------	--	--	--	--	5x
38	Dinkelman loam, 25 to 45 percent slopes	19	VIe-1	53	------	--	--	--	--	5r
39	Disautel silt loam, 0 to 8 percent slopes	20	IIIe-2	52	IIIe-1	54	4	5	61	--
40	Disautel silt loam, 8 to 15 percent slopes	20	IIIe-2	52	------	--	--	5	61	--
41	Disautel silt loam, 15 to 25 percent slopes	20	IVe-3	52	------	--	--	5	61	--
42	Disautel very cobbly silt loam, 8 to 45 percent slopes, eroded	20	VIs-3	53	------	--	--	4	61	--
43	Disautel extremely stony silt loam, 0 to 25 percent slopes	20	VIs-3	53	------	---	--	4	61	--
44	Disautel extremely stony silt loam, 25 to 65 percent slopes	20	VIIs-1	53	------	--	--	4	61	--
45	Donavan loam, 3 to 8 percent slopes	21	IIIe-1	51	------	--	--	--	--	4o
46	Donavan loam, 8 to 25 percent slopes	21	IVe-2	52	------	--	--	--	--	4o
47	Donavan loam, 25 to 65 percent slopes	21	VIe-1	53	------	--	--	--	--	4r
48	Donavan extremely stony loam, 0 to 25 percent slopes	21	VIs-1	53	------	--	--	--	--	4x
49	Donavan extremely stony loam, 25 to 65 percent slopes	21	VIIs-1	53	------	--	--	--	--	4x
50	Donavan-Rock outcrop complex, 25 to 65 percent slopes	21	VIIs-1	53	------	--	--	--	--	4x (Donavan)
51	Emdent loam	22	VIw-1	53	------	--	--	--	--	2w

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
52	Ewall sand, 0 to 15 percent slopes	22	VIIe-1	53	-------	--	--	1	60	--
53	Ewall loamy fine sand, 0 to 15 percent slopes	22	VIe-2	53	IVe-1	55	3	1	60	--
54	Ewall loamy fine sand, 15 to 25 percent slopes	22	VIe-2	53	VIe-1	55	3	1	60	--
55	Ewall loamy fine sand, 25 to 45 percent slopes	22	VIe-2	53	-------	--	--	1	60	--
56	Haley fine sandy loam, 0 to 8 percent slopes	23	IVe-3	52	IIIe-1	54	5	5	61	--
57	Haley fine sandy loam, 8 to 25 percent slopes	23	IVe-3	52	IVe-1	55	5	5	61	--
58	Haley fine sandy loam, 25 to 45 percent slopes	23	VIe-2	53	-------	--	--	5	61	--
59	Havillah silt loam, 0 to 8 percent slopes	24	IIIe-1	51	-------	--	--	8	62	3o
60	Havillah silt loam, 8 to 15 percent slopes	24	IIIe-1	51	-------	--	--	8	62	3o
61	Havillah silt loam, 15 to 25 percent slopes	24	IVe-1	52	-------	--	--	8	62	3o
62	Havillah silt loam, 15 to 45 percent slopes, eroded	24	VIe-2	53	-------	--	--	8	62	--
63	Havillah extremely stony silt loam, 15 to 45 percent slopes	24	VIs-1	53	-------	--	--	8	62	4x
64	Hodgson silt loam, 3 to 15 percent slopes	25	IIIe-1	51	-------	--	--	--	--	3o
65	Hum silt loam, 8 to 20 percent slopes	26	IIIe-1	51	-------	--	--	8	62	--
66	Hunters silt loam, 0 to 8 percent slopes	27	IIIe-1	51	-------	--	--	8	62	2o
67	Hunters silt loam, 8 to 15 percent slopes	27	IIIe-1	51	-------	--	--	8	62	2o
68	Hunters silt loam, 8 to 25 percent slopes, eroded	27	IVe-1	52	-------	--	--	8	62	2o
69	Hunters silt loam, 25 to 45 percent slopes	27	VIe-2	53	-------	--	--	8	62	2r
70	Karamin sandy loam, 8 to 25 percent slopes	28	IVe-2	52	-------	--	--	--	--	4o
71	Kartar sandy loam, 3 to 15 percent slopes	28	IVe-2	52	IVe-1	55	7	5	61	4o
72	Kartar sandy loam, 15 to 25 percent slopes	28	IVe-2	52	-------	--	--	5	61	4o
73	Kartar sandy loam, 15 to 45 percent north slopes	28	VIe-1	53	-------	--	--	--	--	4r
74	Kartar extremely stony sandy loam, 0 to 25 percent slopes	28	VIs-1	53	-------	--	--	5	61	4x
75	Kartar extremely stony sandy loam, 25 to 65 percent slopes	29	VIIs-1	53	-------	--	--	5	61	4x
76	Koepke silt loam, 0 to 8 percent slopes	29	IIIe-1	51	-------	--	--	8	62	3o
77	Koepke silt loam, 8 to 15 percent slopes	29	IIIe-1	51	-------	--	--	8	62	3o
78	Koepke silt loam, 15 to 25 percent slopes	29	IVe-1	52	-------	--	--	8	62	3o
79	Koepke silt loam, 25 to 45 percent slopes	29	VIe-2	53	-------	--	--	8	62	3r

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
80	Koepke gravelly silt loam, 3 to 25 percent slopes	29	IVe-1	52	------	--	--	8	62	3o
81	Leader fine sandy loam, 0 to 8 percent slopes	30	IVe-2	52	IIIe-1	54	7	--	--	4o
82	Leader fine sandy loam, 8 to 25 percent slopes	30	IVe-2	52	------	--	--	--	--	4o
83	Leader fine sandy loam, 25 to 45 percent slopes	30	VIe-1	53	------	--	--	--	--	4r
84	Leavenworth silt loam	31	IIIw-1	52	------	--	--	--	--	2w
85	Lithic Xerochrepts-Cashmont complex, 15 to 45 percent slopes	31	VIIs-1	53	------	--	--	4 (Lithic Xerochrepts) 3 (Cashmont)	61 61	--
86	Lithic Xerochrepts-Conconully complex, 15 to 45 percent slopes	31	VIIs-1	53	------	--	--	4	61	--
87	Lithic Xerochrepts-Donavan-Rock outcrop complex, 15 to 45 percent slopes	31	VIIs-1	53	------	--	--	4 (Lithic Xerochrepts)	61	4x (Donavan)
88	Lithic Xerochrepts-Hum complex, 0 to 45 percent slopes	31	VIIs-1	53	------	--	--	6 (Lithic Xerochrepts) 8 (Hum)	62 62	--
89	Lithic Xerochrepts-Kartar complex, 15 to 45 percent slopes	31	VIIs-1	53	------	--	--	4 (Lithic Xerochrepts) 5 (Kartar)	61 61	4x (Kartar)
90	Lithic Xerochrepts-Molson complex, 15 to 45 percent slopes	32	VIIs-1	53	------	--	--	6 (Lithic Xerochrepts) 8 (Molson)	62 62	3x (Molson)
91	Lithic Xerochrepts-Nevine complex, 15 to 45 percent slopes	32	VIIs-1	53	------	--	--	--	--	4x (Nevine)

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
92	Lithic Xerochrepts-Newbon complex, 15 to 45 percent slopes	32	VIIs-1	53	------	--	--	4 (Lithic Xerochrepts)	61	--
								5 (Newbon)	61	
93	Lithic Xerochrepts-Night-Hawk complex, 15 to 45 percent slopes	32	VIIs-1	53	------	--	--	4	61	--
94	Lithic Xerochrepts-Republic complex, 15 to 45 percent slopes	32	VIIs-1	53	------	--	--	6 (Lithic Xerochrepts)	62	4x (Republic)
								8 (Republic)	62	
95	Lithic Xerochrepts-Vallan complex, 15 to 45 percent slopes	32	VIIs-1	53	------	--	--	6	62	5d (Vallan)
96	Lithic Xerochrepts-Wadams complex, 25 to 65 percent slopes	32	VIIs-1	53	------	--	--	--	--	4x (Wadams)
97	Marsh	32	VIIIw-1	54	------	--	--	--	--	--
98	Merkel sandy loam, 0 to 25 percent slopes	33	IVe-2	52	------	--	--	--	--	4o
99	Merkel extremely stony sandy loam, 3 to 25 percent slopes	33	VIs-1	53	------	--	--	--	--	4x
100	Merkel extremely stony sandy loam, 25 to 65 percent slopes	33	VIIs-1	53	------	--	--	--	--	4x
101	Mires gravelly sandy loam, 25 to 45 percent slopes	34	VIe-2	53	------	--	--	7	62	4r
102	Mires extremely stony sandy loam, 15 to 65 percent slopes	34	VIIs-1	53	------	--	--	7	62	4x
103	Mires loam, 0 to 8 percent slopes	34	IVe-1	52	------	--	--	7	62	4o
104	Mires gravelly loam, 3 to 25 percent slopes	34	IVe-1	52	------	--	--	7	62	4o
105	Molson silt loam, 0 to 8 percent slopes	35	IIIe-1	51	------	--	--	8	62	3o
106	Molson silt loam, 8 to 15 percent slopes	35	IIIe-1	51	------	--	--	8	62	3o
107	Molson silt loam, 15 to 25 percent slopes	35	IVe-1	52	------	--	--	8	62	3o
108	Molson silt loam, 25 to 45 percent slopes	35	VIe-1	53	------	--	--	8	62	3r
109	Molson gravelly silt loam, 3 to 25 percent slopes	35	IVe-1	52	------	--	--	8	62	3o
110	Molson extremely stony silt loam, 8 to 25 percent slopes	35	VIs-3	53	------	--	--	8	62	3x

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
111	Molson extremely stony silt loam, 25 to 45 percent slopes	35	VIIs-1	53	------	--	--	8	62	3x
112	Nespelem silt loam, 3 to 8 percent slopes	36	IIIe-2	52	------	--	--	5	61	--
113	Nespelem silt loam, 8 to 15 percent slopes	36	IIIe-2	52	------	--	--	5	61	--
114	Nespelem silt loam, 15 to 25 percent slopes	36	IVe-3	52	------	--	--	5	61	--
115	Nespelem silt loam, 8 to 25 percent slopes, eroded	36	IVe-3	52	------	--	--	5	61	--
116	Nespelem silt loam, 25 to 45 percent slopes	36	VIe-2	53	------	--	--	5	61	--
117	Nespelem silt loam, alkali, 0 to 3 percent slopes	36	VIs-2	53	------	--	--	2	60	--
118	Nevine silt loam, 8 to 25 percent slopes	37	IVe-2	52	------	--	--	--	--	3o
119	Nevine silt loam, 25 to 45 percent slopes	37	VIe-1	53	------	--	--	--	--	3r
120	Nevine extremely stony silt loam, 0 to 25 percent slopes	37	VIs-1	53	------	--	--	--	--	4x
121	Nevine extremely stony silt loam, 25 to 65 percent slopes	37	VIIs-1	53	------	--	--	--	--	4x
122	Newbon loam, 3 to 8 percent slopes	38	IIIe-2	52	IIIe-1	54	4	5	61	--
123	Newbon loam, 8 to 15 percent slopes	38	IIIe-2	52	IVe-1	55	4	5	61	--
124	Newbon loam, 15 to 25 percent slopes	38	IVe-3	52	VIe-1	55	4	5	61	--
125	Newbon gravelly loam, 0 to 8 percent slopes	38	IIIe-2	52	IIIe-1	54	4	5	61	--
126	Newbon gravelly loam, 8 to 25 percent slopes	38	IVe-3	52	IVe-1	55	4	5	61	--
127	Newbon gravelly loam, 25 to 45 percent slopes	38	VIe-2	53	------	--	--	5	61	--
128	Newbon gravelly loam, 25 to 45 percent north slopes	38	VIe-2	53	------	--	--	5	61	4r
129	Newbon very gravelly loam, 25 to 65 percent slopes, eroded	38	VIIe-1	53	------	--	--	4	61	--
130	Newbon extremely stony loam, 0 to 45 percent slopes	38	VIs-3	53	------	--	--	5	61	--
131	Nighthawk loam, 3 to 8 percent slopes	39	IIIe-2	52	IIIe-1	54	1	5	61	--
132	Nighthawk loam, 8 to 15 percent slopes	39	IIIe-2	52	IVe-1	55	1	5	61	--
133	Nighthawk loam, 15 to 25 percent slopes	39	IVe-3	52	VIe-1	55	1	5	61	--
134	Nighthawk extremely stony loam, 8 to 25 percent slopes	39	VIs-3	53	------	--	--	4	61	--
135	Nighthawk extremely stony loam, 25 to 65 percent slopes	39	VIIs-1	53	------	--	--	4	61	--
136	Nighthawk extremely stony loam, 25 to 65 percent slopes, eroded	39	VIIs-1	53	------	--	--	4	61	--
137	Okanogan loam	40	IIIw-1	52	IIw-1	54	1	5	61	--

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
138	Okanogan loam, gravelly substratum	40	IIIw-1	52	IIw-1	54	1	5	61	--
139	Owhi fine sandy loam, 0 to 3 percent slopes	41	IVe-3	52	IIe-1	54	5	5	61	5o
140	Owhi fine sandy loam, 3 to 8 percent slopes	41	IVe-3	52	IIIe-1	54	5	5	61	5o
141	Owhi gravelly fine sandy loam, 0 to 8 percent slopes	42	VIe-2	53	IVe-1	55	5	5	61	--
142	Owhi gravelly fine sandy loam, 8 to 25 percent slopes	42	VIe-2	53	VIe-1	55	5	5	61	--
143	Owhi extremely stony fine sandy loam, 0 to 25 percent slopes	42	VIs-3	53	VIs-1	55	6	4	61	--
144	Owhi extremely stony fine sandy loam, 25 to 45 percent slopes	42	VIIs-1	53	------	--	--	4	61	--
145	Pogue fine sandy loam, 0 to 3 percent slopes	42	IVe-3	52	IIe-1	54	2	3	61	--
146	Pogue fine sandy loam, 3 to 8 percent slopes	42	IVe-3	52	IIIe-1	54	2	3	61	--
147	Pogue fine sandy loam, 8 to 15 percent slopes	43	IVe-3	52	IVe-1	55	2	3	61	--
148	Pogue fine sandy loam, 15 to 25 percent slopes	43	IVe-3	52	VIe-1	55	2	3	61	--
149	Pogue gravelly fine sandy loam, 0 to 8 percent slopes	43	VIe-2	53	IVe-1	55	2	3	61	--
150	Pogue gravelly fine sandy loam, 8 to 25 percent slopes	43	VIe-2	53	IVe-1	55	2	3	61	--
151	Pogue extremely stony fine sandy loam, 0 to 25 percent slopes	44	VIs-3	53	VIs-1	55	6	3	61	--
152	Pogue extremely stony fine sandy loam, 25 to 65 percent slopes	44	VIIs-1	53	------	--	--	3	61	--
153	Republic gravelly sandy loam, 3 to 15 percent slopes	44	IVe-1	52	------	--	--	7	62	3o
154	Republic gravelly sandy loam, 15 to 25 percent slopes	44	IVe-1	52	------	--	--	7	62	3o
155	Republic extremely stony sandy loam, 15 to 45 percent slopes	44	VIs-3	53	------	--	--	7	62	4x
156	Republic loam, 0 to 8 percent slopes	45	IIIe-1	51	------	--	--	8	62	3o
157	Republic loam, 8 to 15 percent slopes	45	IIIe-1	51	------	--	--	8	62	3o
158	Republic loam, 15 to 25 percent slopes	45	IVe-1	52	------	--	--	8	62	3o
159	Republic loam, 25 to 45 percent slopes	45	VIe-2	53	------	--	--	8	62	3r
160	Republic loam, gravelly substratum, 0 to 8 percent slopes	45	IIIe-1	51	------	--	--	8	62	3o
161	Riverwash	45	VIIIw-1	54	------	--	--	--	--	--
162	Rock outcrop	45	VIIIs-1	54	------	--	--	--	--	--

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Orchard group Number	Range site Number	Range site Page	Woodland suitability Symbol
163	Skaha loamy sand, 0 to 8 percent slopes	45	VIe-2	53	IVe-1	55	3	1	60	--
164	Skaha gravelly loamy sand, 0 to 15 percent slopes	46	VIe-2	53	VIe-1	55	3	1	60	--
165	Skaha gravelly loamy sand, 15 to 25 percent slopes	46	VIe-2	53	--------	--	--	1	60	--
166	Skaha gravelly loamy sand, 25 to 65 percent slopes	46	VIIe-1	53	------	--	--	1	60	--
167	Springdale sandy loam, 0 to 3 percent slopes	46	IVe-2	52	IVe-1	55	--	--	--	5f
168	Springdale sandy loam, 3 to 8 percent slopes	46	IVe-2	52	IVe-1	55	--	--	--	5f
169	Springdale sandy loam, 8 to 25 percent slopes	46	VIe-1	53	------	--	--	--	--	5f
170	Springdale extremely stony sandy loam, 0 to 25 percent slopes	46	VIs-1	53	------	--	--	--	--	5x
171	Springdale extremely stony sandy loam, 25 to 45 percent slopes	47	VIs-1	53	------	--	--	--	--	5x
172	Synarep silt loam	47	IVw-1	52	------	--	--	2	60	--
173	Tonasket silt loam, 0 to 3 percent slopes	48	IIIc-1	52	IIe-1	54	1	5	61	--
174	Tonasket silt loam, 3 to 8 percent slopes	48	IIIe-2	52	IIIe-1	54	1	5	61	--
175	Tonasket silt loam, 8 to 15 percent slopes	48	IIIe-2	52	IVe-1	55	1	5	61	--
176	Tonasket silt loam, 15 to 25 percent slopes	48	IVe-3	52	VIe-1	55	1	5	61	--
177	Tonasket silt loam, 25 to 45 percent slopes	48	VIe-2	53	------	--	--	5	61	--
178	Tonasket extremely stony silt loam, 0 to 45 percent slopes	48	VIs-3	53	------	--	--	5	61	--
179	Wadams sandy loam, 3 to 15 percent slopes	49	IVe-2	52	IVe-1	55	7	--	--	4o
180	Wadams extremely stony sandy loam, 0 to 25 percent slopes	49	VIs-1	53	------	--	--	--	--	4x
181	Wadams extremely stony sandy loam, 25 to 65 percent slopes	49	VIIs-1	53	------	--	--	--	--	4x
182	Winthrop gravelly loamy sand, 0 to 15 percent slopes	50	VIe-2	53	IVs-1	55	3	--	--	5s
183	Winthrop extremely stony loamy sand, 0 to 45 percent slopes	50	VIs-3	53	------	--	--	--	--	5x
184	Xerofluvents, wet	50	VIw-1	53	------	--	--	--	--	2w

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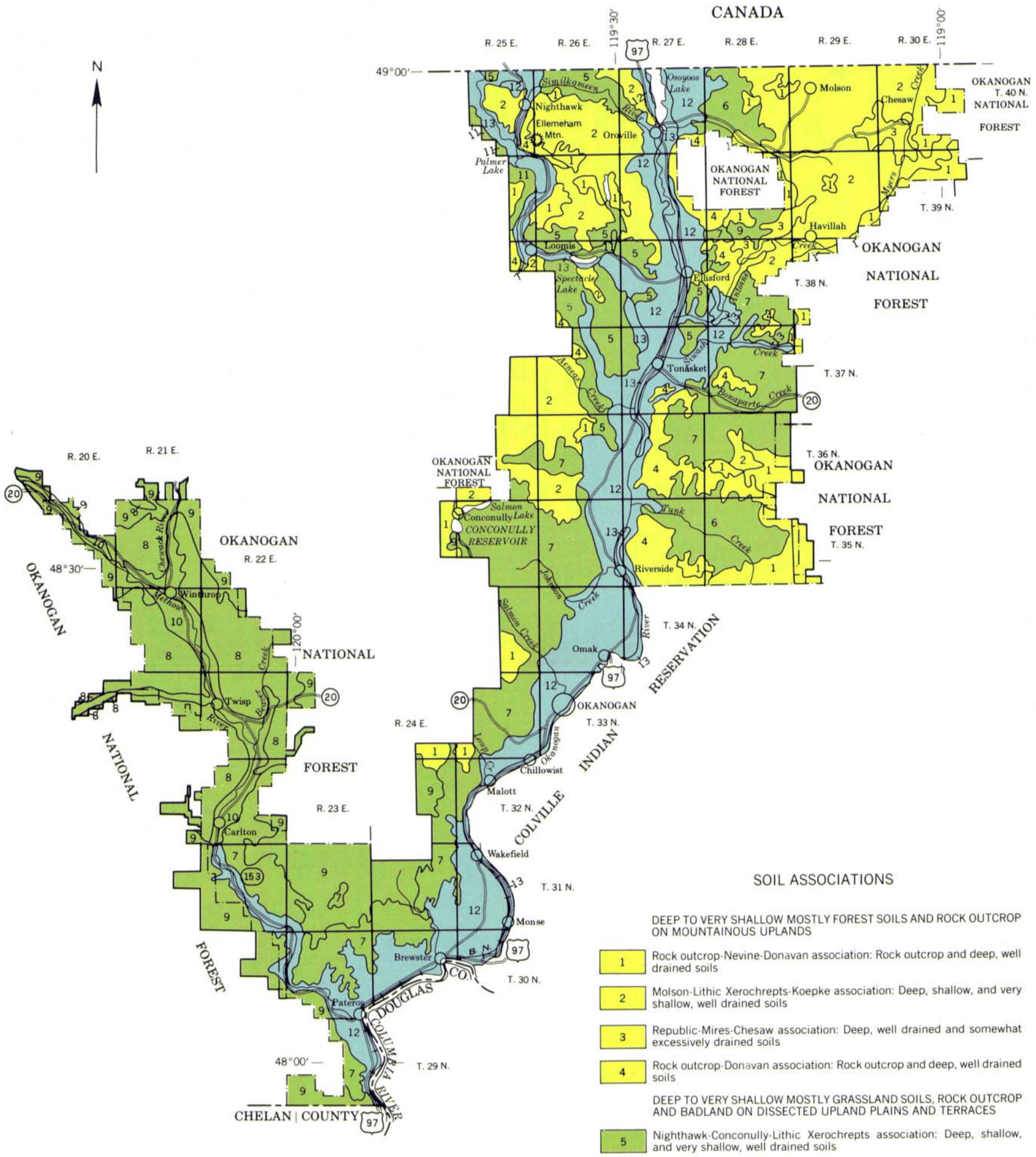


SOIL ASSOCIATIONS

DEEP TO VERY SHALLOW MOSTLY FOREST SOILS AND ROCK OUTCROP ON MOUNTAINOUS UPLANDS

1 — Rock outcrop-Nevine-Donavan association: Rock outcrop and deep, well drained soils

2 — Molson-Lithic Xerochrepts-Koepke association: Deep, shallow, and very shallow, well drained soils

3 — Republic-Mires-Chesaw association: Deep, well drained and somewhat excessively drained soils

4 — Rock outcrop-Donavan association: Rock outcrop and deep, well drained soils

DEEP TO VERY SHALLOW MOSTLY GRASSLAND SOILS, ROCK OUTCROP AND BADLAND ON DISSECTED UPLAND PLAINS AND TERRACES

5 — Nighthawk-Conconully-Lithic Xerochrepts association: Deep, shallow, and very shallow, well drained soils

6 — Disautel-Conconully-Nespelem association: Deep, well drained soils

7 — Conconully-Lithic Xerochrepts-Haley association: Deep, shallow, and very shallow, well drained soils

8 — Newbon-Conconully association: Deep, well drained soils

9 — Kartar-Dinkelman-Springdale association: Deep, well drained and somewhat excessively drained soils

10 — Owhi-Winthrop association: Deep, well drained and excessively drained soils

11 — Badland-Rock outcrop association: Nearly barren severely eroded areas and Rock outcrop

DEEP, MOSTLY GRASSLAND AND MEADOW SOILS ON TERRACES AND FLOOD PLAINS

12 — Pogue-Cashmont-Cashmere association: Deep, somewhat excessively drained and well drained soils

13 — Colville-Okanogan association: Deep, somewhat poorly drained and well drained soils

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WASHINGTON STATE UNIVERSITY AGRICULTURAL RESEARCH CENTER

GENERAL SOIL MAP

OKANOGAN COUNTY AREA, WASHINGTON

Scale 1: 506,880
1 0 1 2 3 4 5 6 7 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Compiled 1979

INDEX TO MAP SHEETS

OKANOGAN COUNTY AREA, WASHINGTON

Scale 1:506,880

1 0 1 2 3 4 5 6 7 Miles

SOIL LEGEND

SYMBOL	NAME
1	Aeneas fine sandy loam, 0 to 3 percent slopes
2	Aeneas fine sandy loam, 3 to 8 percent slopes
3	Aeneas fine sandy loam, 8 to 15 percent slopes
4	Badland
5	Boesel fine sandy loam
6	Boesel silt loam, heavy subsoil variant
7	Cashmere fine sandy loam, 0 to 3 percent slopes
8	Cashmere fine sandy loam, 3 to 8 percent slopes
9	Cashmere fine sandy loam, 8 to 15 percent slopes
10	Cashmere fine sandy loam, 15 to 25 percent slopes
11	Cashmere fine sandy loam, 25 to 65 percent slopes
12	Cashmont sandy loam, 0 to 3 percent slopes
13	Cashmont sandy loam, 3 to 8 percent slopes
14	Cashmont sandy loam, 8 to 15 percent slopes
15	Cashmont sandy loam, 15 to 25 percent slopes
16	Cashmont gravelly sandy loam, 0 to 8 percent slopes
17	Cashmont gravelly sandy loam, 8 to 15 percent slopes
18	Cashmont very gravelly sandy loam, 3 to 25 percent slopes
19	Cashmont extremely stony sandy loam, 0 to 25 percent slopes
20	Cashmont extremely stony sandy loam, 25 to 45 percent slopes
21	Chesaw gravelly sandy loam, 15 to 45 percent slopes
22	Chesaw extremely stony sandy loam, 15 to 45 percent slopes
23	Colville silt loam
24	Colville silt loam, moderately wet
25	Conconully gravelly sandy loam, 3 to 8 percent slopes
26	Conconully gravelly sandy loam, 8 to 25 percent slopes
27	Conconully loam, 0 to 8 percent slopes
28	Conconully loam, 8 to 15 percent slopes
29	Conconully loam, 15 to 25 percent slopes
30	Conconully extremely stony loam, 0 to 25 percent slopes
31	Conconully extremely stony loam, 25 to 65 percent slopes
32	Conconully extremely stony loam, 25 to 65 percent north slopes
33	Dinkelman sandy loam, 0 to 25 percent slopes
34	Dinkelman sandy loam, 25 to 65 percent slopes
35	Dinkelman gravelly sandy loam, 3 to 25 percent slopes
36	Dinkelman extremely stony sandy loam, 0 to 25 percent slopes
37	Dinkelman extremely stony sandy loam, 25 to 65 percent slopes
38	Dinkelman loam, 25 to 45 percent slopes
39	Disautel silt loam, 0 to 8 percent slopes
40	Disautel silt loam, 8 to 15 percent slopes
41	Disautel silt loam, 15 to 25 percent slopes
42	Disautel very cobbly silt loam, 8 to 45 percent slopes, eroded
43	Disautel extremely stony silt loam, 0 to 25 percent slopes
44	Disautel extremely stony silt loam, 25 to 65 percent slopes
45	Donovan loam, 3 to 8 percent slopes
46	Donovan loam, 8 to 25 percent slopes
47	Donovan loam, 25 to 65 percent slopes
48	Donovan extremely stony loam, 0 to 25 percent slopes
49	Donovan extremely stony loam, 25 to 65 percent slopes
50	Donovan-Rock outcrop complex, 25 to 65 percent slopes
51	Emdent loam
52	Ewall sand, 0 to 15 percent slopes
53	Ewall loamy fine sand, 0 to 15 percent slopes
54	Ewall loamy fine sund, 15 to 25 percent slopes
55	Ewall loamy fine sand, 25 to 45 percent slopes
56	Haley fine sandy loam, 0 to 8 percent slopes
57	Haley fine sandy loam, 8 to 25 percent slopes
58	Haley fine sandy loam, 25 to 45 percent slopes
59	Havillah silt loam, 0 to 8 percent slopes
60	Havillah silt loam, 8 to 15 percent slopes
61	Havillah silt loam, 15 to 25 percent slopes
62	Havillah silt loam, 15 to 45 percent slopes, eroded
63	Havillah extremely stony silt loam, 15 to 45 percent slopes
64	Hodgson silt loam, 3 to 15 percent slopes
65	Hum silt loam, 8 to 20 percent slopes
66	Hunters silt loam, 0 to 8 percent slopes
67	Hunters silt loam, 8 to 15 percent slopes
68	Hunters silt loam, 8 to 25 percent slopes, eroded
69	Hunters silt loam, 25 to 45 percent slopes
70	Karamin sandy loam, 8 to 25 percent slopes
71	Kartar sandy loam, 3 to 15 percent slopes
72	Kartar sandy loam, 15 to 25 percent slopes
73	Kartar sandy loam, 15 to 45 percent north slopes
74	Kartar extremely stony sandy loam, 0 to 25 percent slopes
75	Kartar extremely stony sandy loam, 25 to 65 percent slopes
76	Koepke silt loam, 0 to 8 percent slopes
77	Koepke silt loam, 8 to 15 percent slopes
78	Koepke silt loam, 15 to 25 percent slopes
79	Koepke silt loam, 25 to 45 percent slopes
80	Koepke gravelly silt loam, 3 to 25 percent slopes
81	Leader fine sandy loam, 0 to 8 percent slopes
82	Leader fine sandy loam, 8 to 25 percent slopes
83	Leader fine sandy loam, 25 to 45 percent slopes
84	Leavenworth silt loam
85	Lithic Xerochrepts-Cashmont complex, 15 to 45 percent slopes
86	Lithic Xerochrepts-Conconully complex, 15 to 45 percent slopes
87	Lithic Xerochrepts-Donovan-Rock outcrop complex, 15 to 45 percent slopes
88	Lithic Xerochrepts-Hum complex, 0 to 45 percent slopes
89	Lithic Xerochrepts-Kartar complex, 15 to 45 percent slopes
90	Lithic Xerochrepts-Molson complex, 15 to 45 percent slopes
91	Lithic Xerochrepts-Nevine complex, 15 to 45 percent slopes
92	Lithic Xerochrepts-Newbon complex, 15 to 45 percent slopes
93	Lithic Xerochrepts-Nighthawk complex, 15 to 45 percent slopes
94	Lithic Xerochrepts-Republic complex, 15 to 45 percent slopes
95	Lithic Xerochrepts-Vallan complex, 15 to 45 percent slopes
96	Lithic Xerochrepts-Wadams complex, 25 to 65 percent slopes
97	Marsh
98	Merkel sandy loam, 0 to 25 percent slopes
99	Merkel extremely stony sandy loam, 3 to 25 percent slopes
100	Merkel extremely stony sandy loam, 25 to 65 percent slopes
101	Mires gravelly sandy loam, 25 to 45 percent slopes
102	Mires extremely stony sandy loam, 15 to 65 percent slopes
103	Mires loam, 0 to 8 percent slopes
104	Mires gravelly loam, 3 to 25 percent slopes
105	Molson silt loam, 0 to 8 percent slopes
106	Molson silt loam, 8 to 15 percent slopes
107	Molson silt loam, 15 to 25 percent slopes
108	Molson silt loam, 25 to 45 percent slopes
109	Molson gravelly silt loam, 3 to 25 percent slopes
110	Molson extremely stony silt loam, 8 to 25 percent slopes
111	Molson extremely stony silt loam, 25 to 45 percent slopes
112	Nespelem silt loam, 3 to 8 percent slopes
113	Nespelem silt loam, 8 to 15 percent slopes
114	Nespelem silt loam, 15 to 25 percent slopes
115	Nespelem silt loam, 8 to 25 percent slopes, eroded
116	Nespelem silt loam, 25 to 45 percent slopes
117	Nespelem silt loam, alkali, 0 to 3 percent slopes
118	Nevine silt loam, 8 to 25 percent slopes
119	Nevine silt loam, 25 to 45 percent slopes
120	Nevine extremely stony silt loam, 0 to 25 percent slopes
121	Nevine extremely stony silt loam, 25 to 65 percent slopes
122	Newbon loam, 3 to 8 percent slopes
123	Newbon loam, 8 to 15 percent slopes
124	Newbon loam, 15 to 25 percent slopes
125	Newbon gravelly loam, 0 to 8 percent slopes
126	Newbon gravelly loam, 8 to 25 percent slopes
127	Newbon gravelly loam, 25 to 45 percent slopes
128	Newbon gravelly loam, 25 to 45 percent north slopes
129	Newbon very gravelly loam, 25 to 65 percent slopes, eroded
130	Newbon extremely stony loam, 0 to 45 percent slopes
131	Nighthawk loam, 3 to 8 percent slopes
132	Nighthawk loam, 8 to 15 percent slopes
133	Nighthawk loam, 15 to 25 percent slopes
134	Nighthawk extremely stony loam, 8 to 25 percent slopes
135	Nighthawk extremely stony loam, 25 to 65 percent slopes
136	Nighthawk extremely stony loam, 25 to 65 percent slopes, eroded
137	Okanogan loam
138	Okanogan loam, gravelly substratum
139	Owhi fine sandy loam, 0 to 3 percent slopes
140	Owhi fine sandy loam, 3 to 8 percent slopes
141	Owhi gravelly fine sandy loam, 0 to 8 percent slopes
142	Owhi gravelly fine sandy loam, 8 to 25 percent slopes
143	Owhi extremely stony fine sandy loam, 0 to 25 percent slopes
144	Owhi extremely stony fine sandy loam, 25 to 45 percent slopes
145	Pogue fine sandy loam, 0 to 3 percent slopes
146	Pogue fine sandy loam, 3 to 8 percent slopes
147	Pogue fine sandy loam, 8 to 15 percent slopes
148	Pogue fine sandy loam, 15 to 25 percent slopes
149	Pogue gravelly fine sandy loam, 0 to 8 percent slopes
150	Pogue gravelly fine sandy loam, 8 to 25 percent slopes
151	Pogue extremely stony fine sandy loam, 0 to 25 percent slopes
152	Pogue extremely stony fine sandy loam, 25 to 65 percent slopes
153	Republic gravelly sandy loam, 3 to 15 percent slopes
154	Republic gravelly sandy loam, 15 to 25 percent slopes
155	Republic extremely stony sandy loam, 15 to 45 percent slopes
156	Republic loam, 0 to 8 percent slopes
157	Republic loam, 8 to 15 percent slopes
158	Republic loam, 15 to 25 percent slopes
159	Republic loam, 25 to 45 percent slopes
160	Republic loam, gravelly substratum, 0 to 8 percent slopes
161	Riverwash
162	Rock outcrop
163	Skaha loamy sand, 0 to 8 percent slopes
164	Skaha gravelly loamy sand, 0 to 15 percent slopes
165	Skaha gravelly loamy sand, 15 to 25 percent slopes
166	Skaha gravelly loamy sand, 25 to 65 percent slopes
167	Springdale sandy loam, 0 to 3 percent slopes
168	Springdale sandy loam, 3 to 8 percent slopes
169	Springdale sandy loam, 8 to 25 percent slopes
170	Springdale extremely stony sandy loam, 0 to 25 percent slopes
171	Springdale extremely stony sandy loam, 25 to 45 percent slopes
172	Synarep silt loam
173	Tonasket silt loam, 0 to 3 percent slopes
174	Tonasket silt loam, 3 to 8 percent slopes
175	Tonasket silt loam, 8 to 15 percent slopes
176	Tonasket silt loam, 15 to 25 percent slopes
177	Tonasket silt loam, 25 to 45 percent slopes
178	Tonasket extremely stony silt loam, 0 to 45 percent slopes
179	Wadams sandy loam, 3 to 15 percent slopes
180	Wadams extremely stony sandy loam, 0 to 25 percent slopes
181	Wadams extremely stony sandy loam, 25 to 65 percent slopes
182	Winthrop gravelly loamy sand, 0 to 15 percent slopes
183	Winthrop extremely stony loamy sand, 0 to 45 percent slopes
184	Xerofluvents, wet

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; W)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; W)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (SvE 107)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

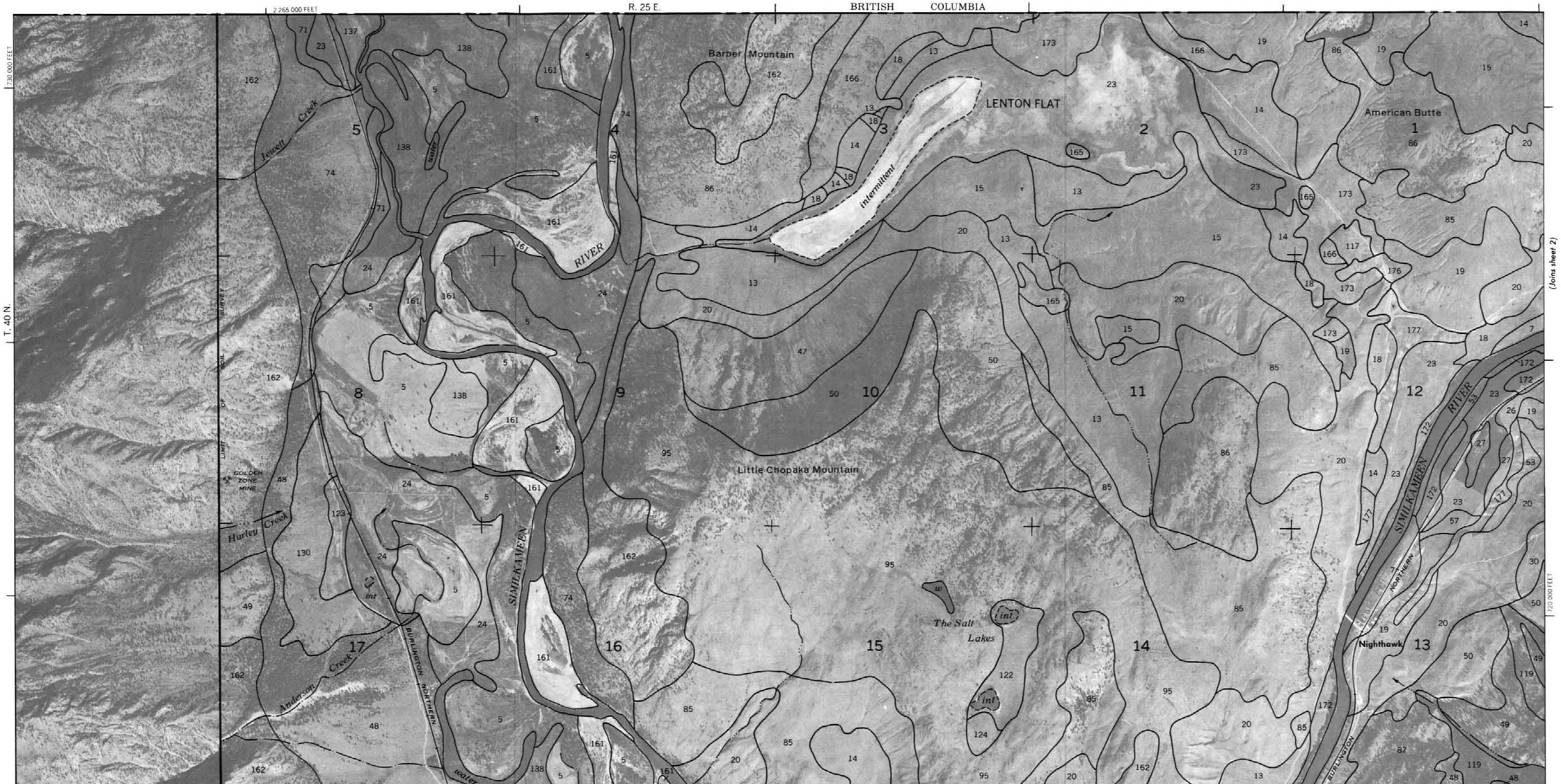
GULLY

DEPRESSION OR SINK

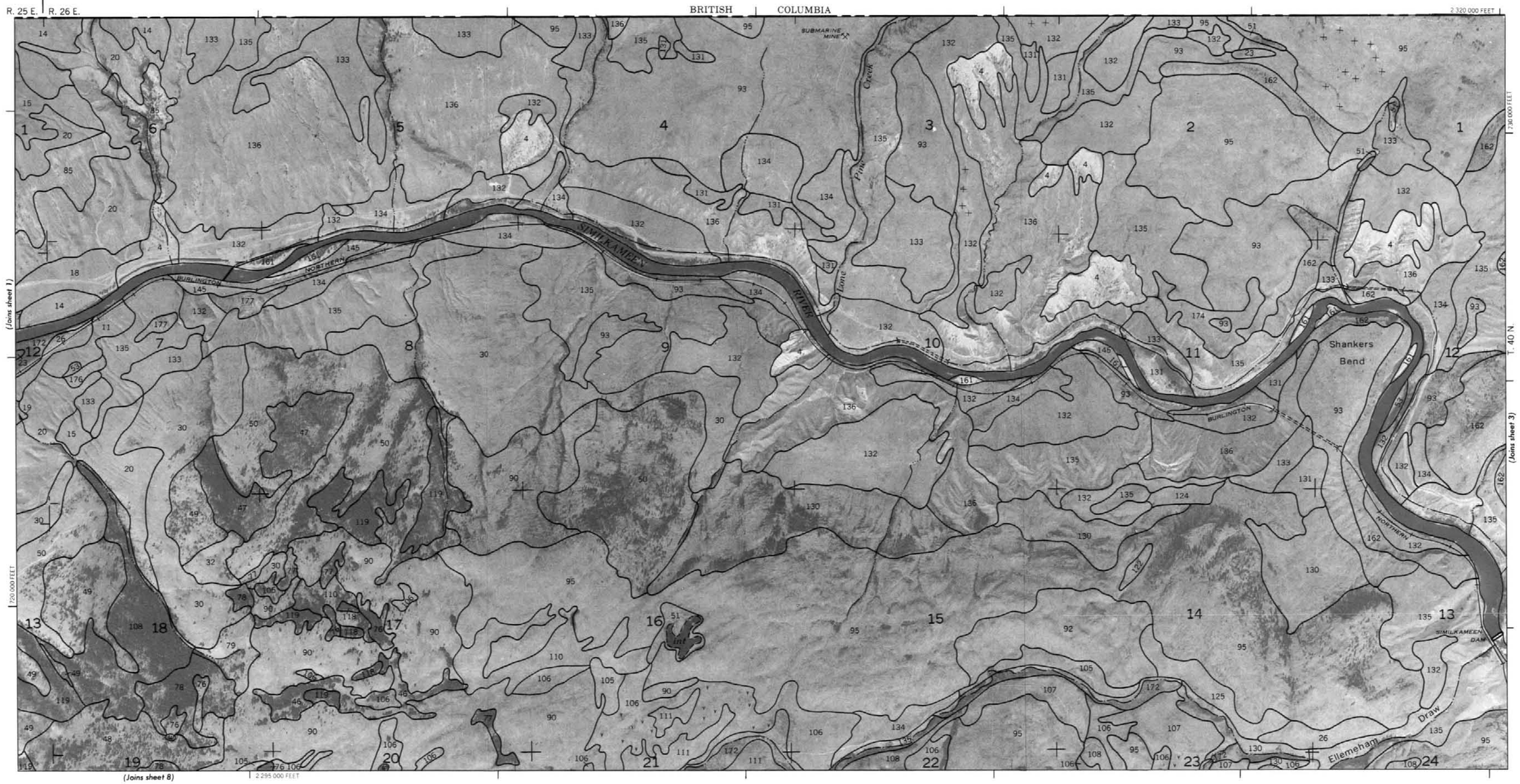
SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot



OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 2

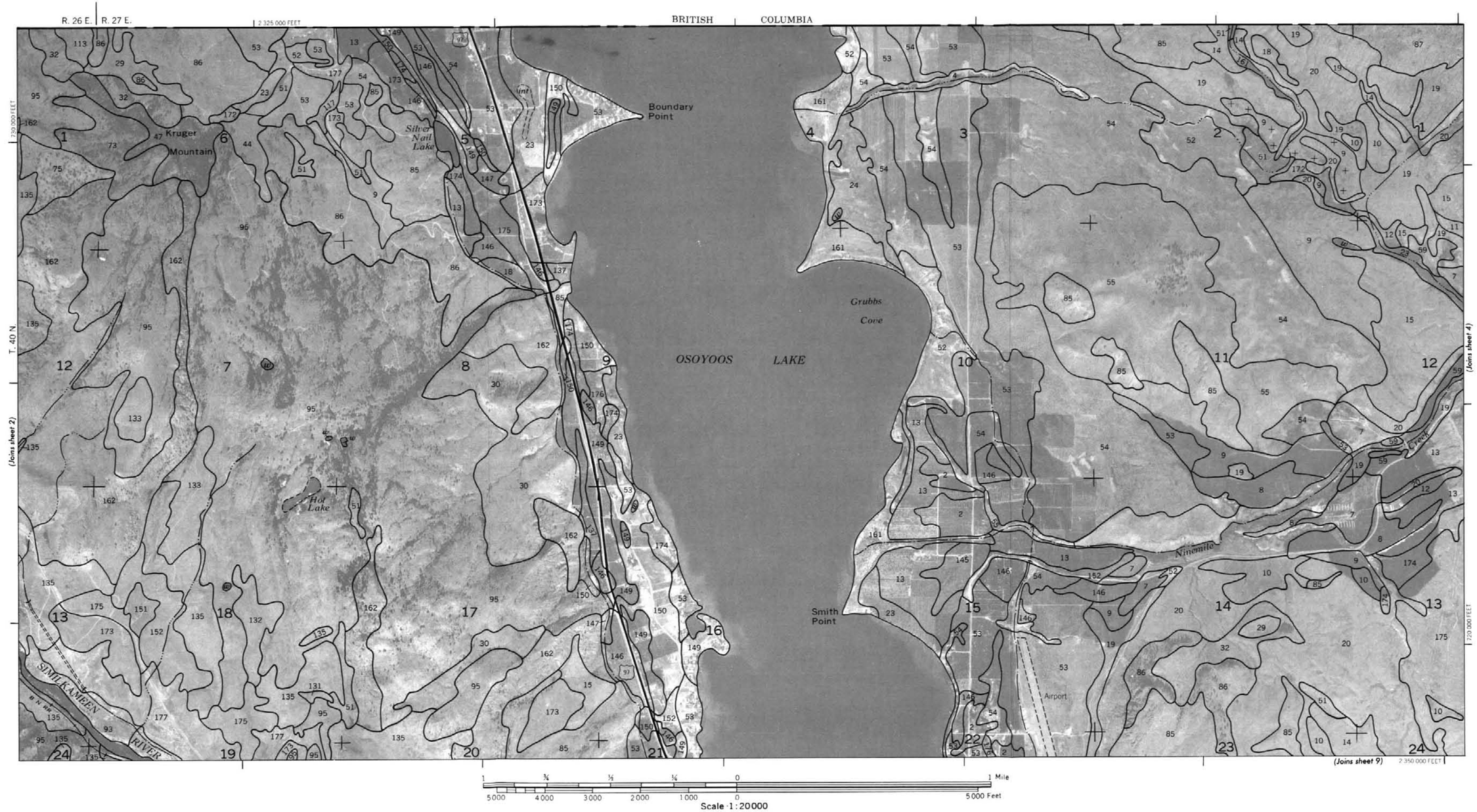


1 Mile
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 4

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 5

5

N

R. 28 E. | R. 29 E.

2 385 000 FEET

BRITISH COLUMBIA

T. 40 N.

730 000 FEET

720 000 FEET

2 410 000 FEET

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 11)

Sidley Lake

Molson Lake

Molson

Molson Hill

Black Hill

Alden Lake

Laura Lake

Lindberg Lake

Aeneas Lake

Mud Lake

Valley

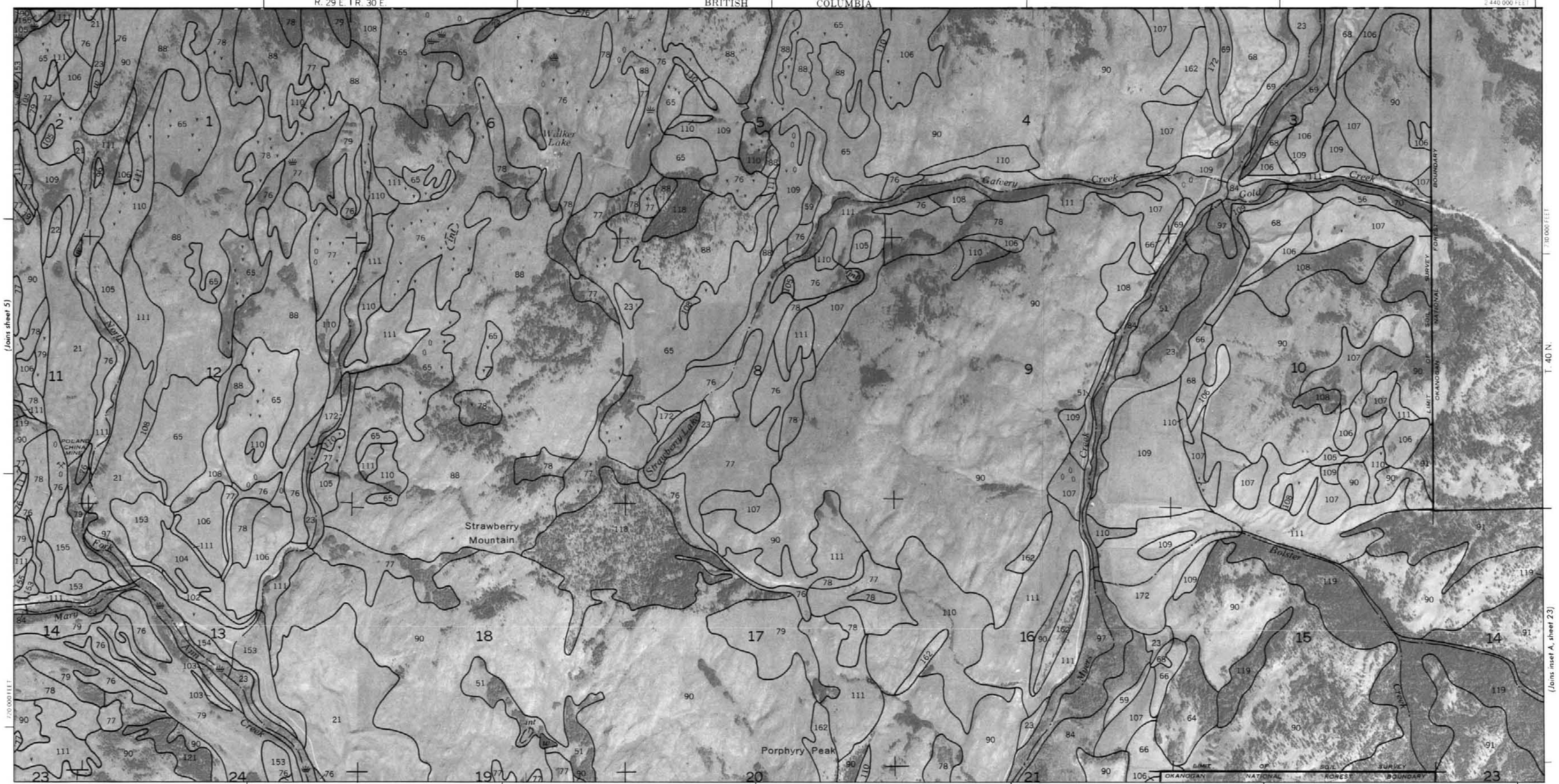
Creek

Scale 1:20000

1 Mile

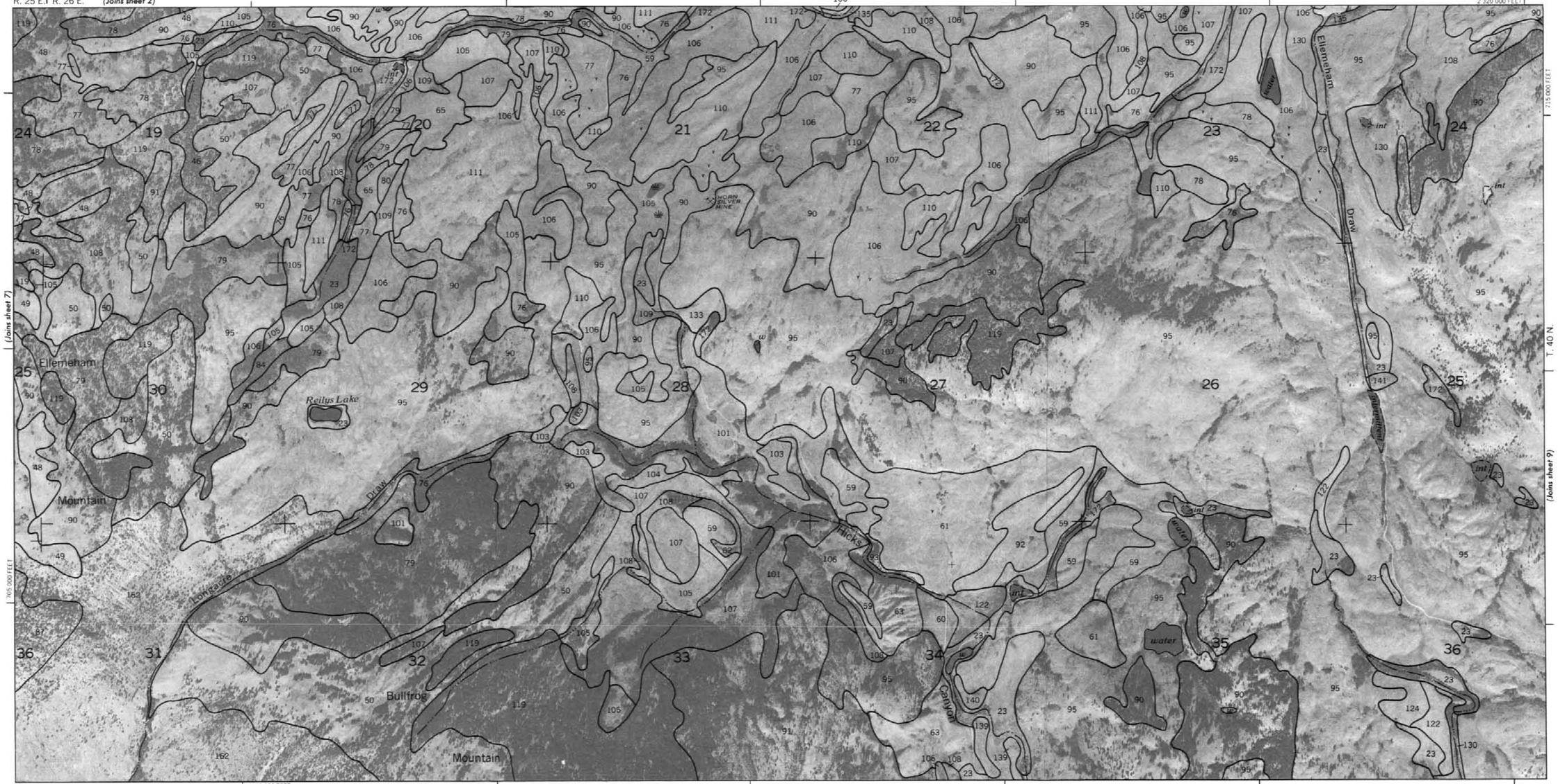
5000 Feet

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

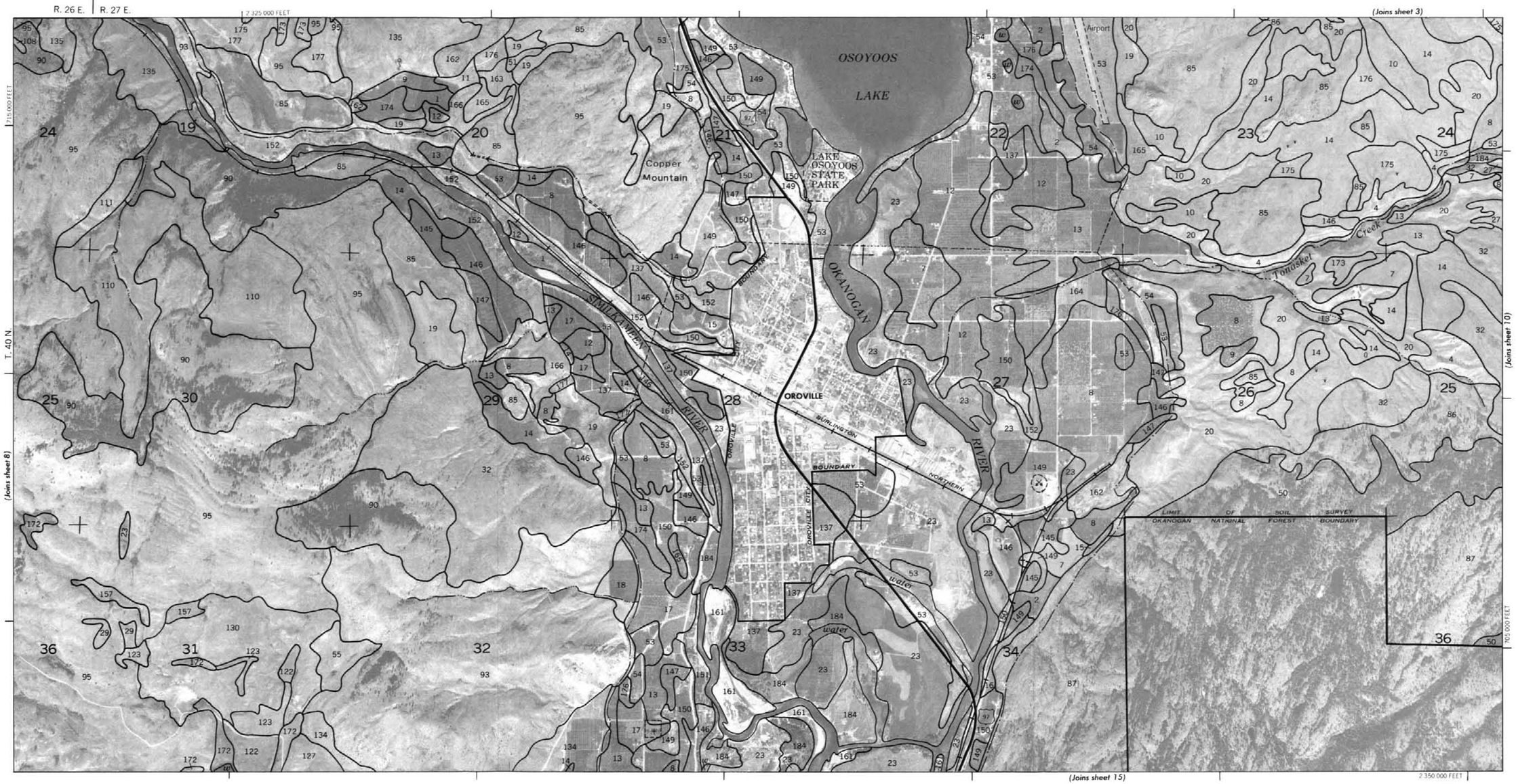


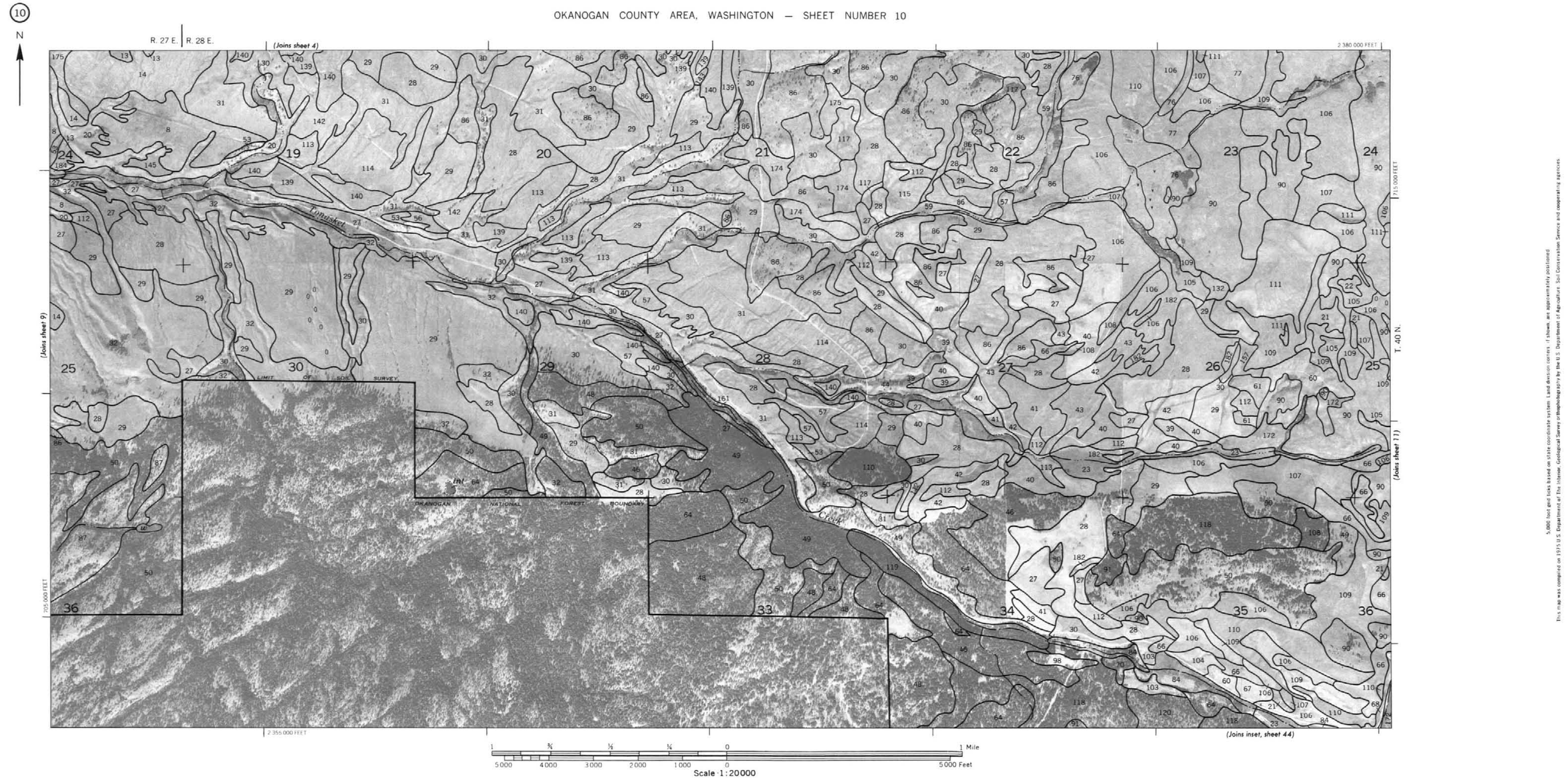
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey Photogeography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies



This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned





This map was compiled on 1975 U.S. Department of the Interior, Geological Survey photomosaic by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

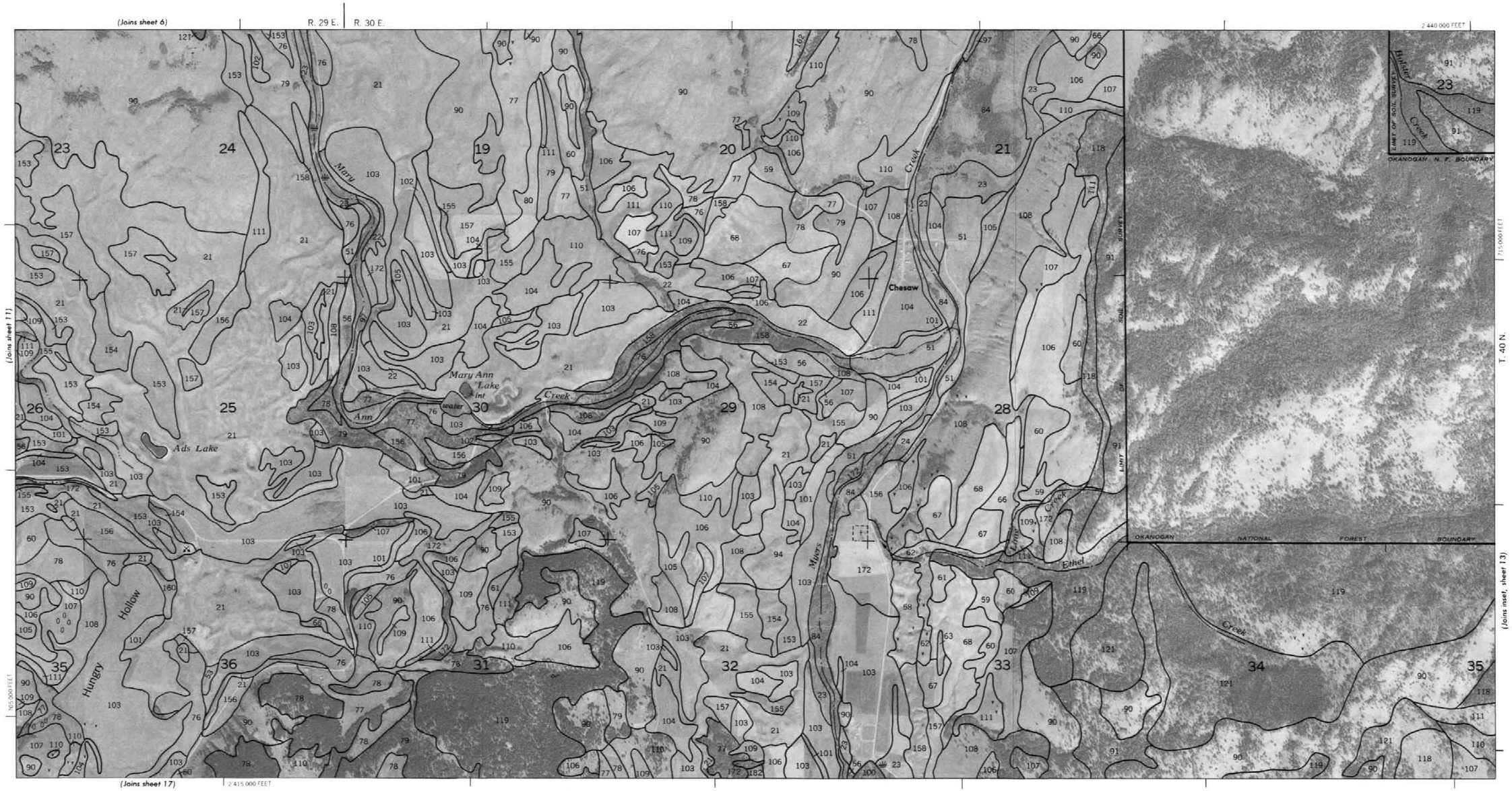
5,000 foot grid ticks based on state coordinate system, Lambert conformal conic projection, zone 1, shown, are approximately positioned

1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 12

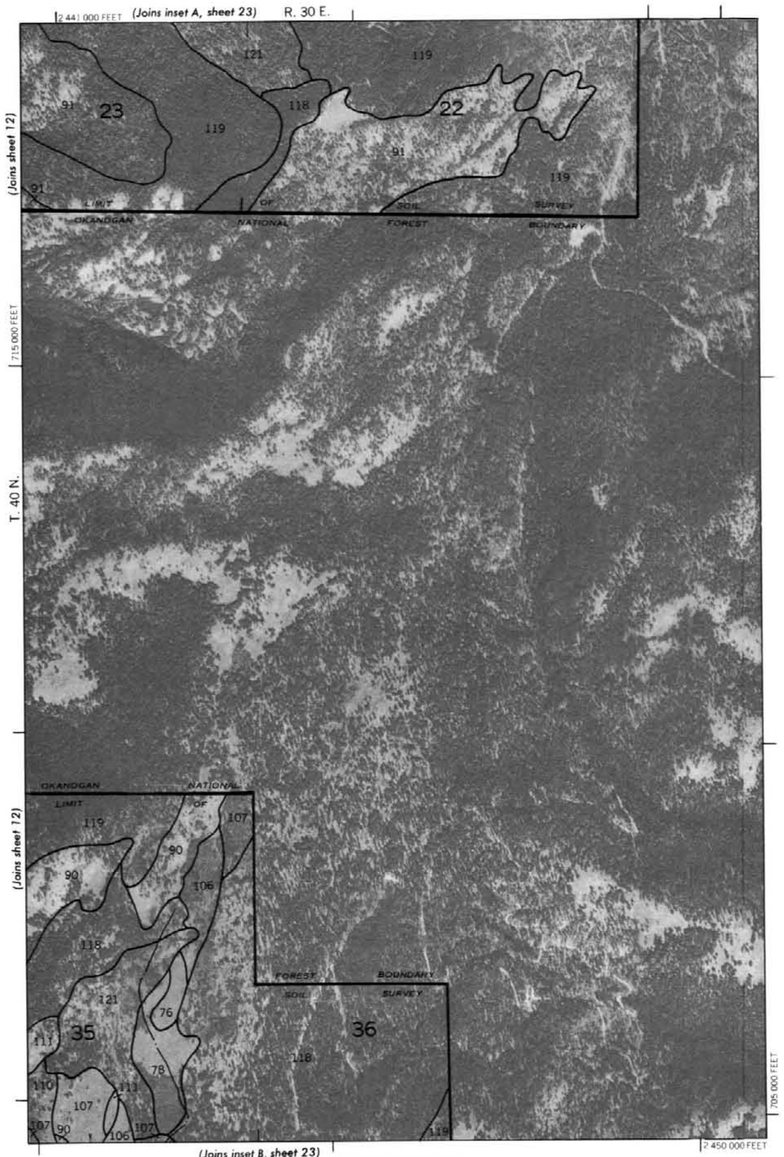


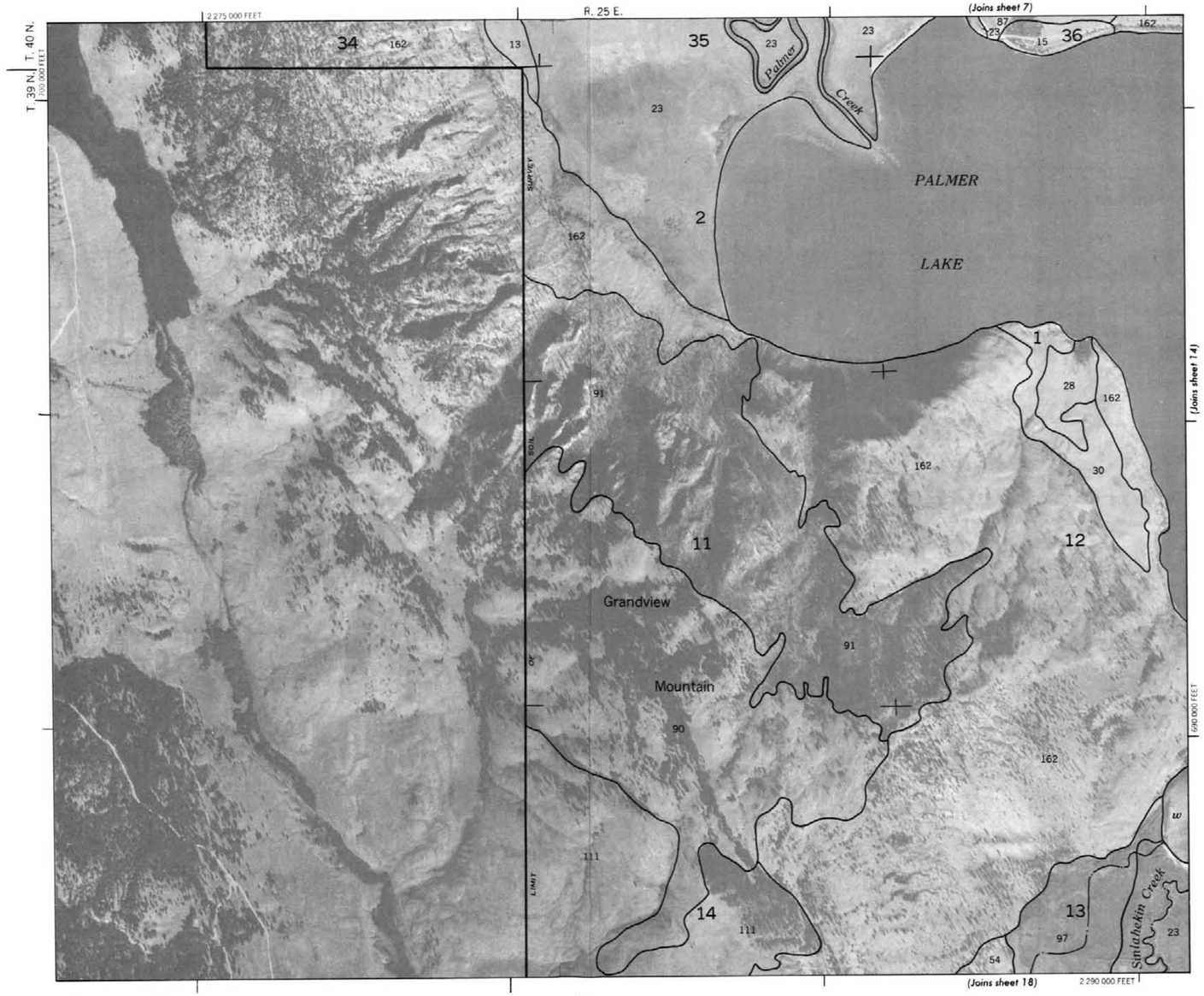
This map was compiled on 1975 UTM grid and tics based on state coordinate system. Land division corners, if shown, are approximately positioned.

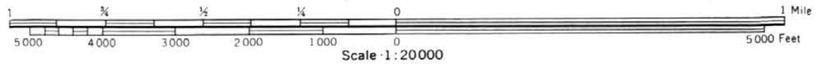
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U.S. Department of the Interior Geological Survey Photobase Map by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies

N

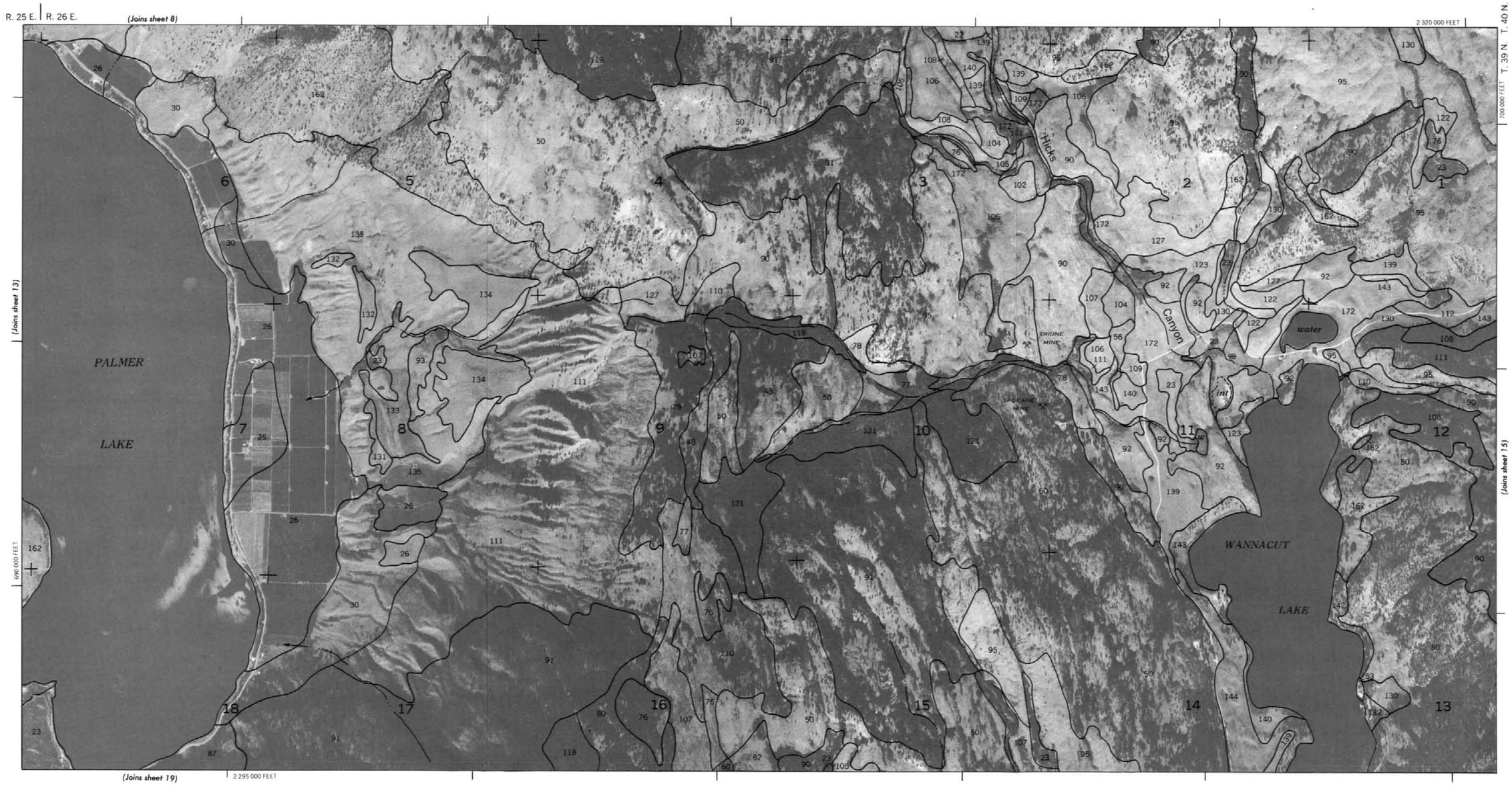






(14)

OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 14

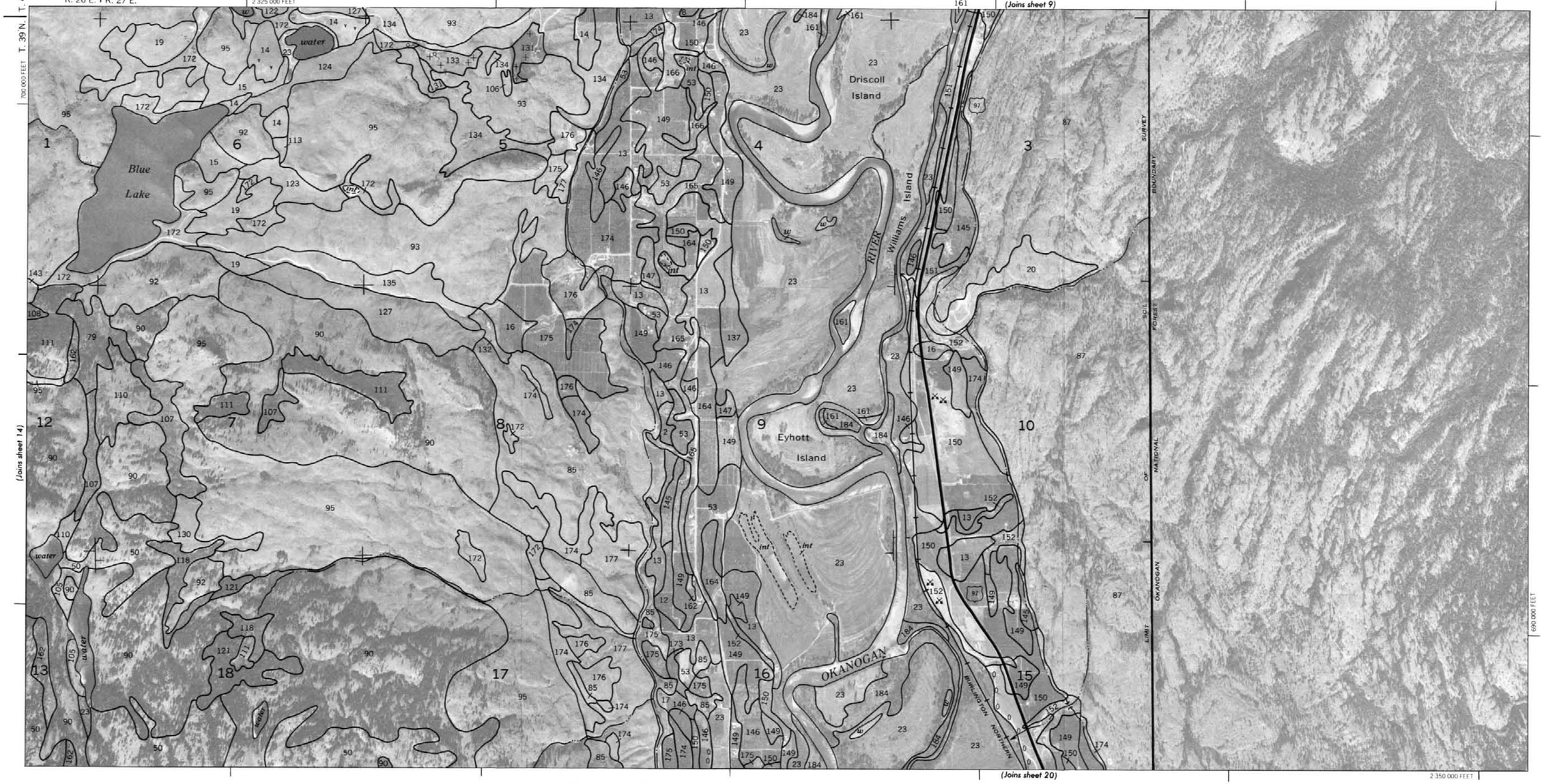


1 Mile
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

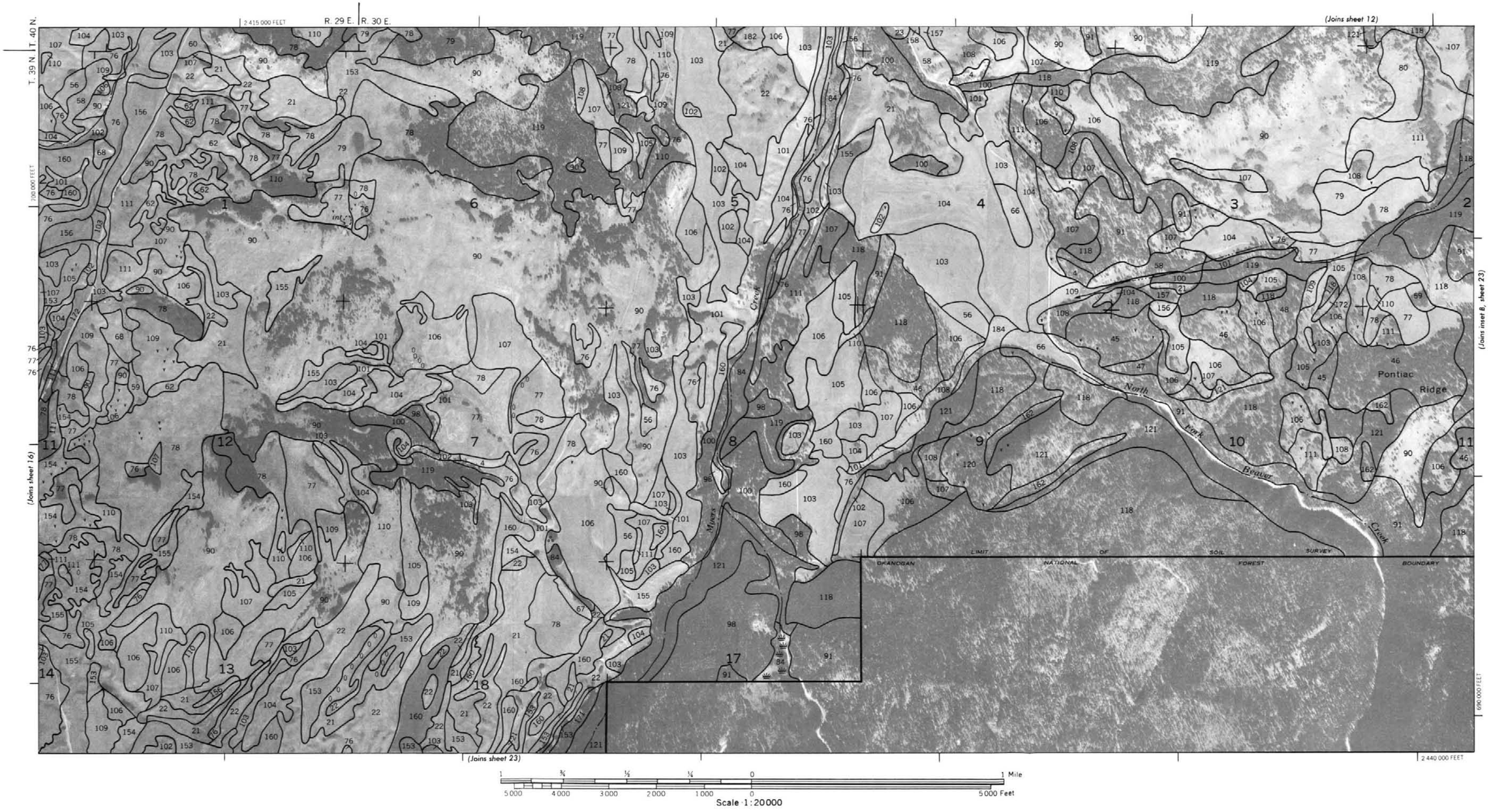
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



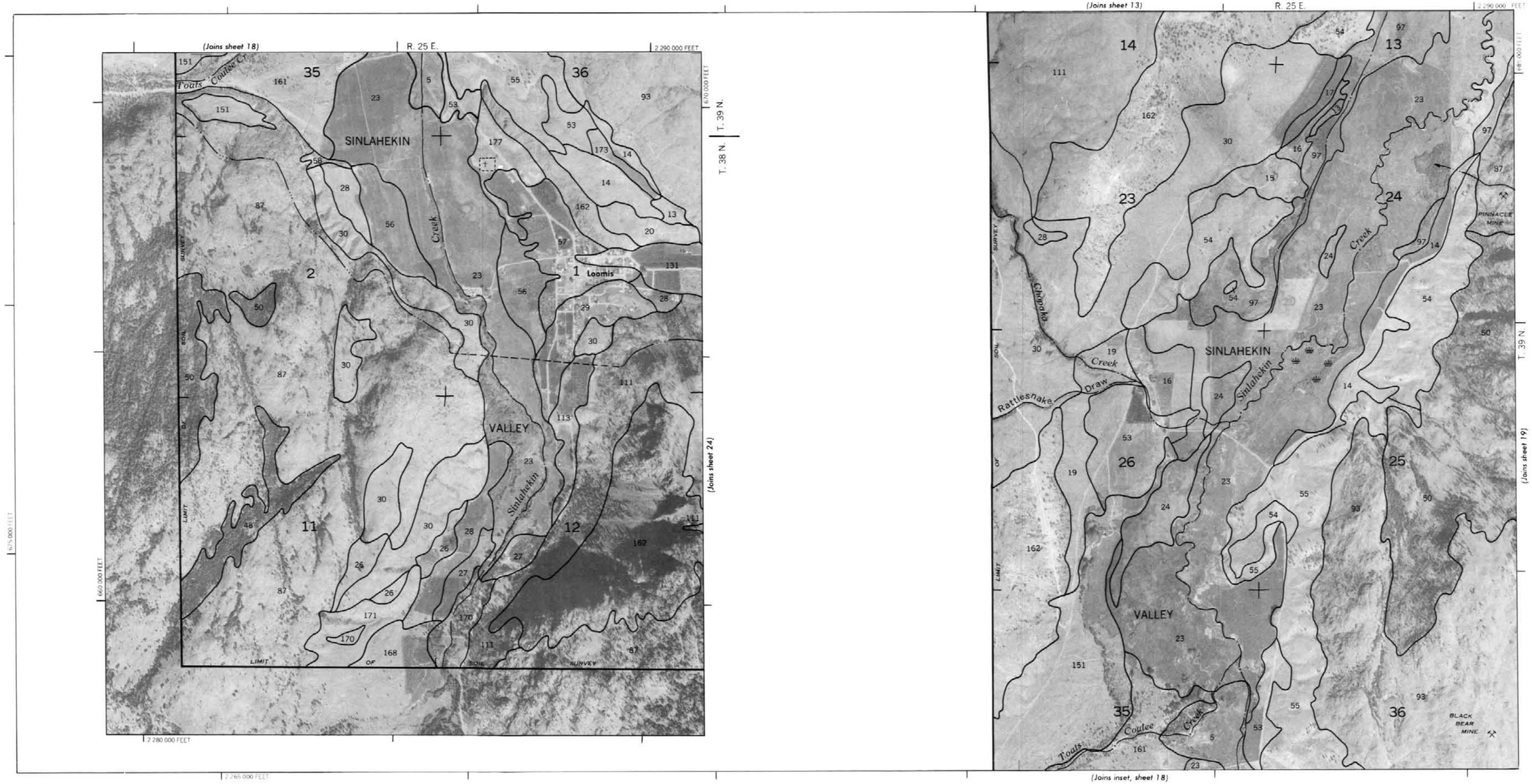
This map was compiled on 1973 U.S. Department of the Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system Land division corners, if shown, are approximately positioned



This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

N



1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

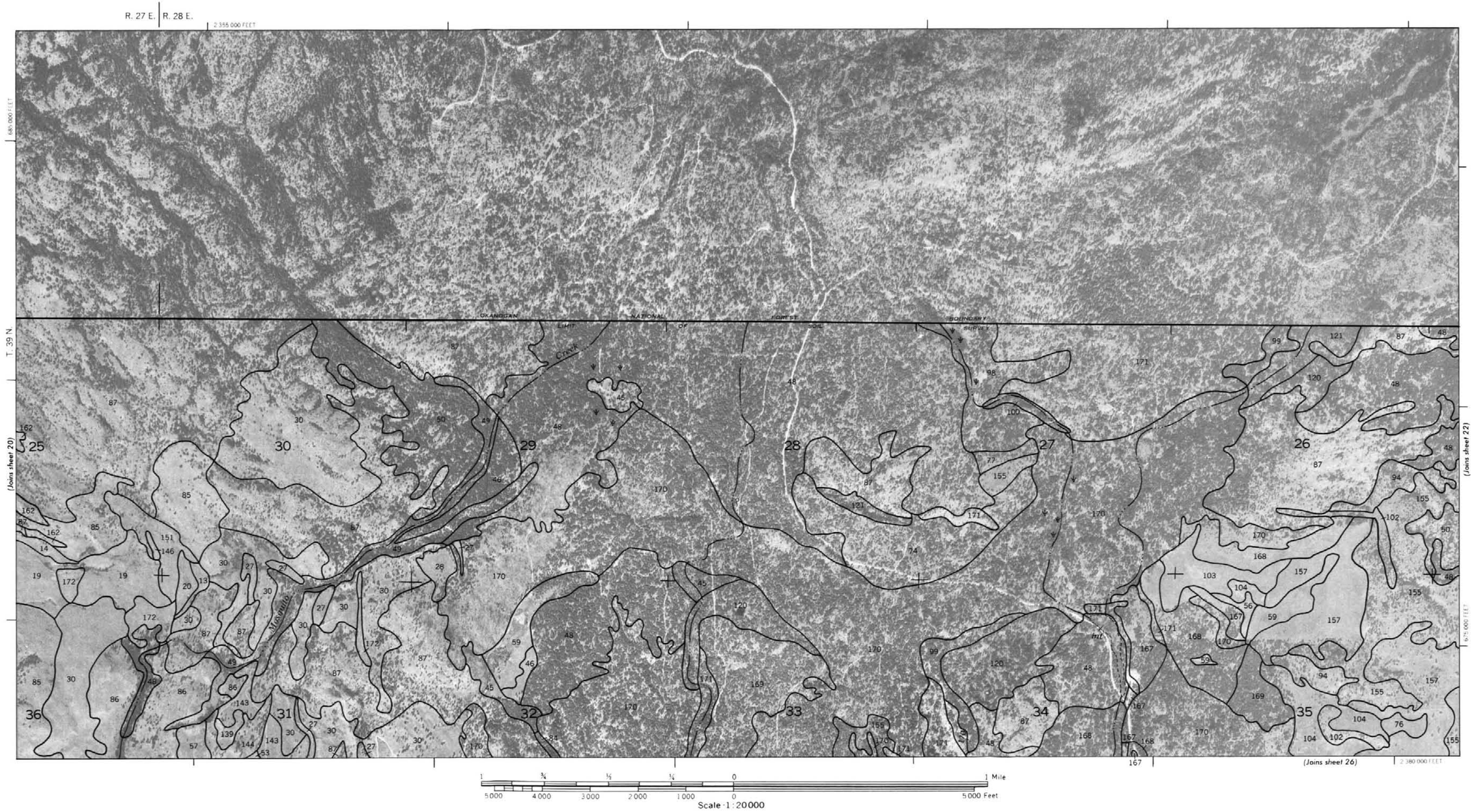
Scale 1:20000

This map was compiled on 1973 U.S. Department of The Interior, Geological Survey aerial photographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5 000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey photography by the U.S. Department of Agriculture - Soil Conservation Service and cooperating agencies



1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey photogrammetric maps by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies

N

This map was compiled on 1979 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture - Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners if shown are approximately positioned

R. 29 E. R. 30 E.

2 415 000 FEET

(Joins sheet 17)

T. 39 N.

485 000 FEET

(Joins sheet 22)

INSET A

R. 30 E.

2 441 000 FEET

T. 40 N.

725 000 FEET

(Joins sheet 6)

(Joins inset, sheet 13)

2 449 000 FEET

720 000 FEET

4000 AND 5000-FOOT GRID TICKS

INSET B

R. 30 E.

2 441 000 FEET

(Joins inset, sheet 13)

T. 39 N.

700 000 FEET

(Joins sheet 17)

695 000 FEET

675 000 FEET

2 450 000 FEET

4000 AND 5000-FOOT GRID TICKS

2 440 000 FEET

OKANOGAN NATIONAL FOREST BOUNDARY

OKANOGAN LIMIT OF NATIONAL FOREST BOUNDARY

SOIL SURVEY LIMIT

Gold Creek

Muers Creek

Miliard Creek

MAGNETIC MINE

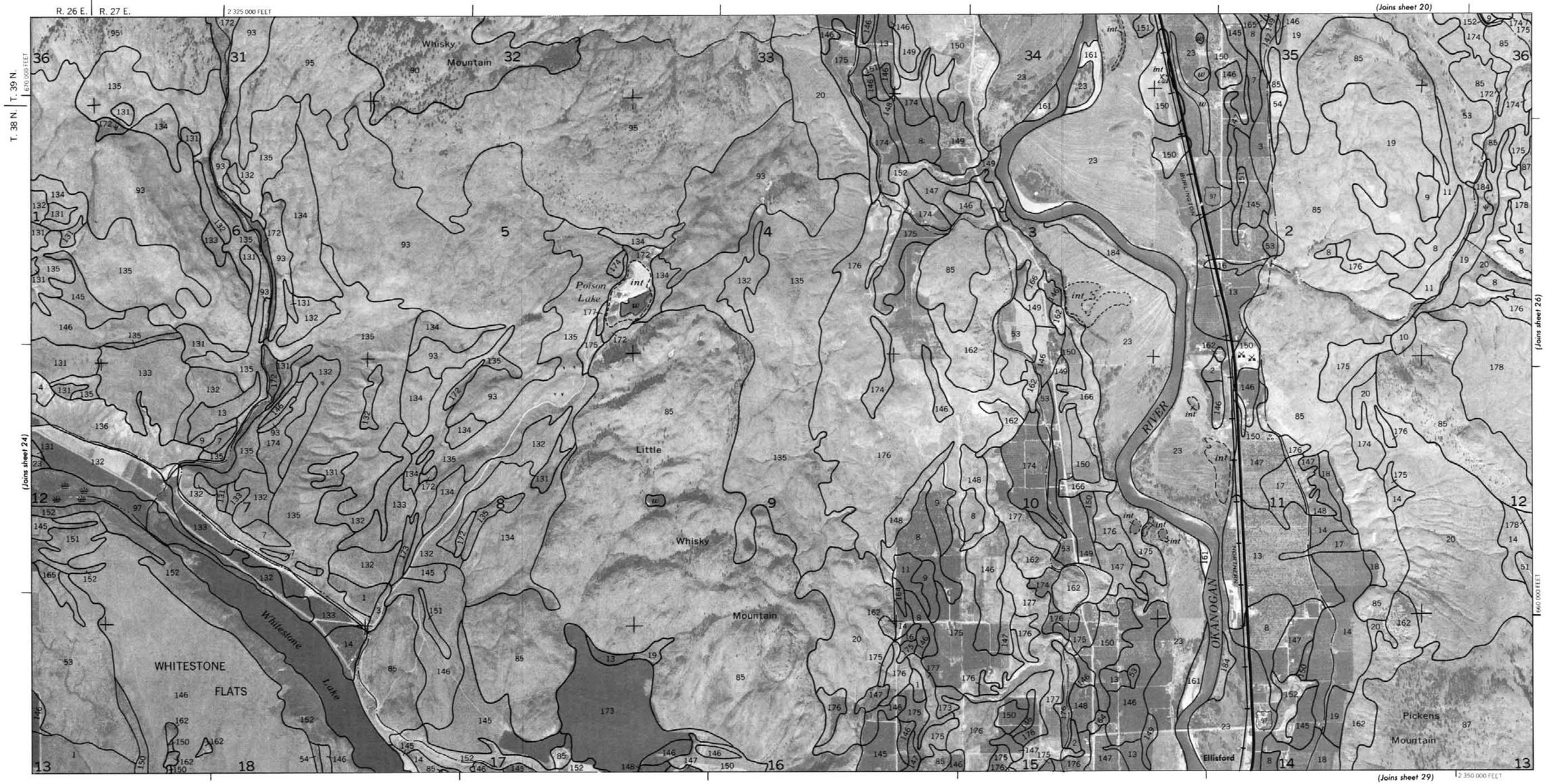
1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

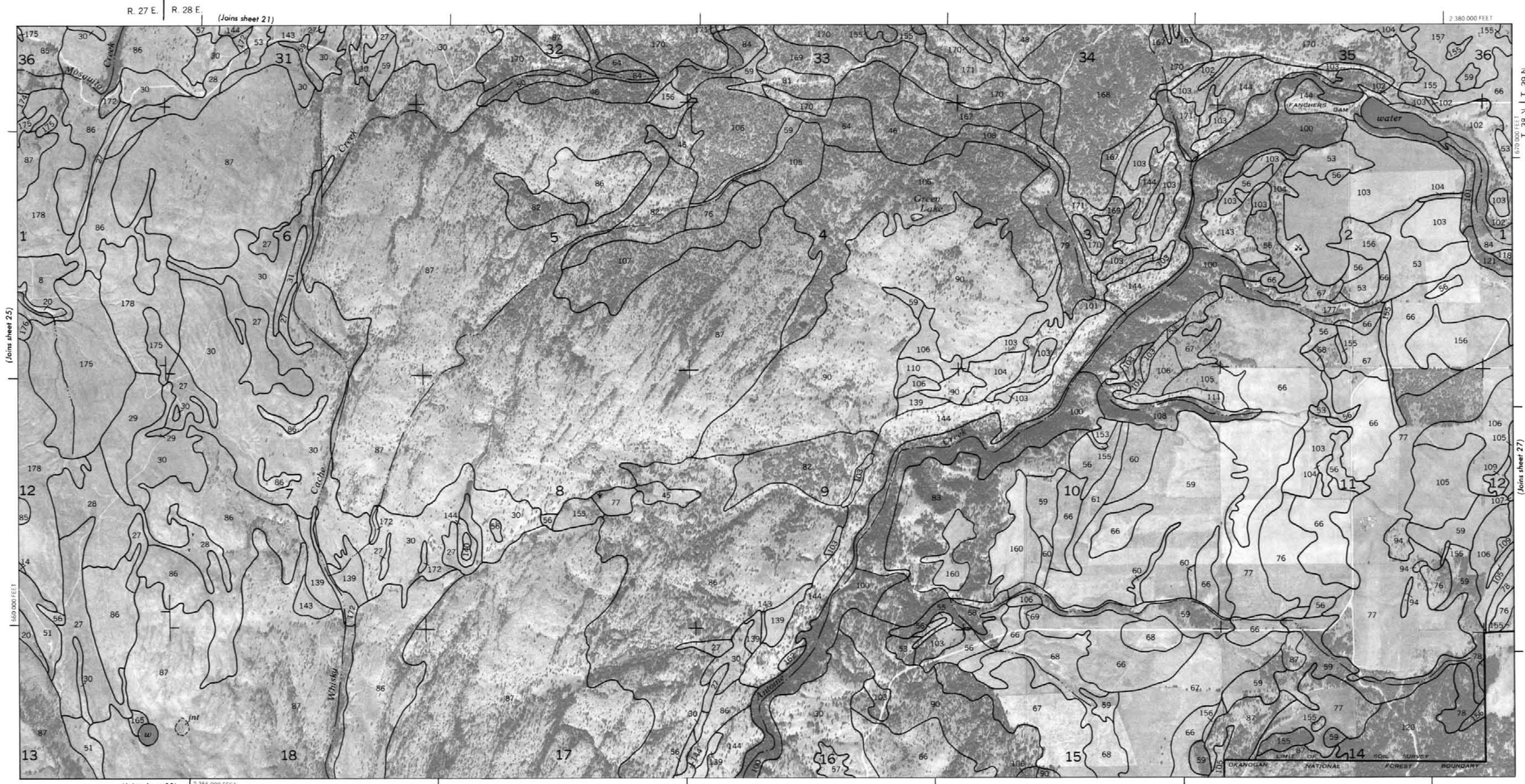
Scale 1:20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

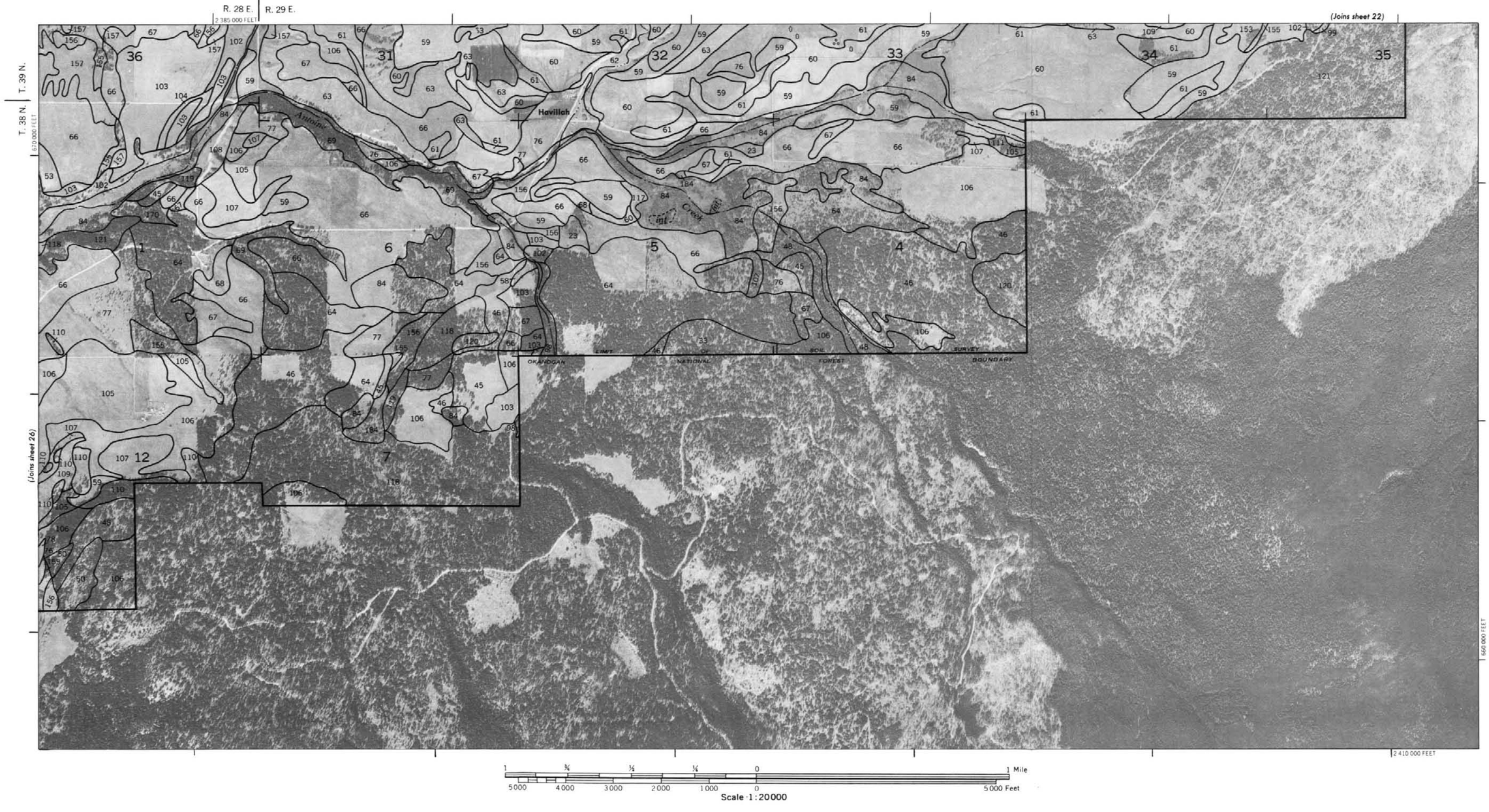


OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 26



5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

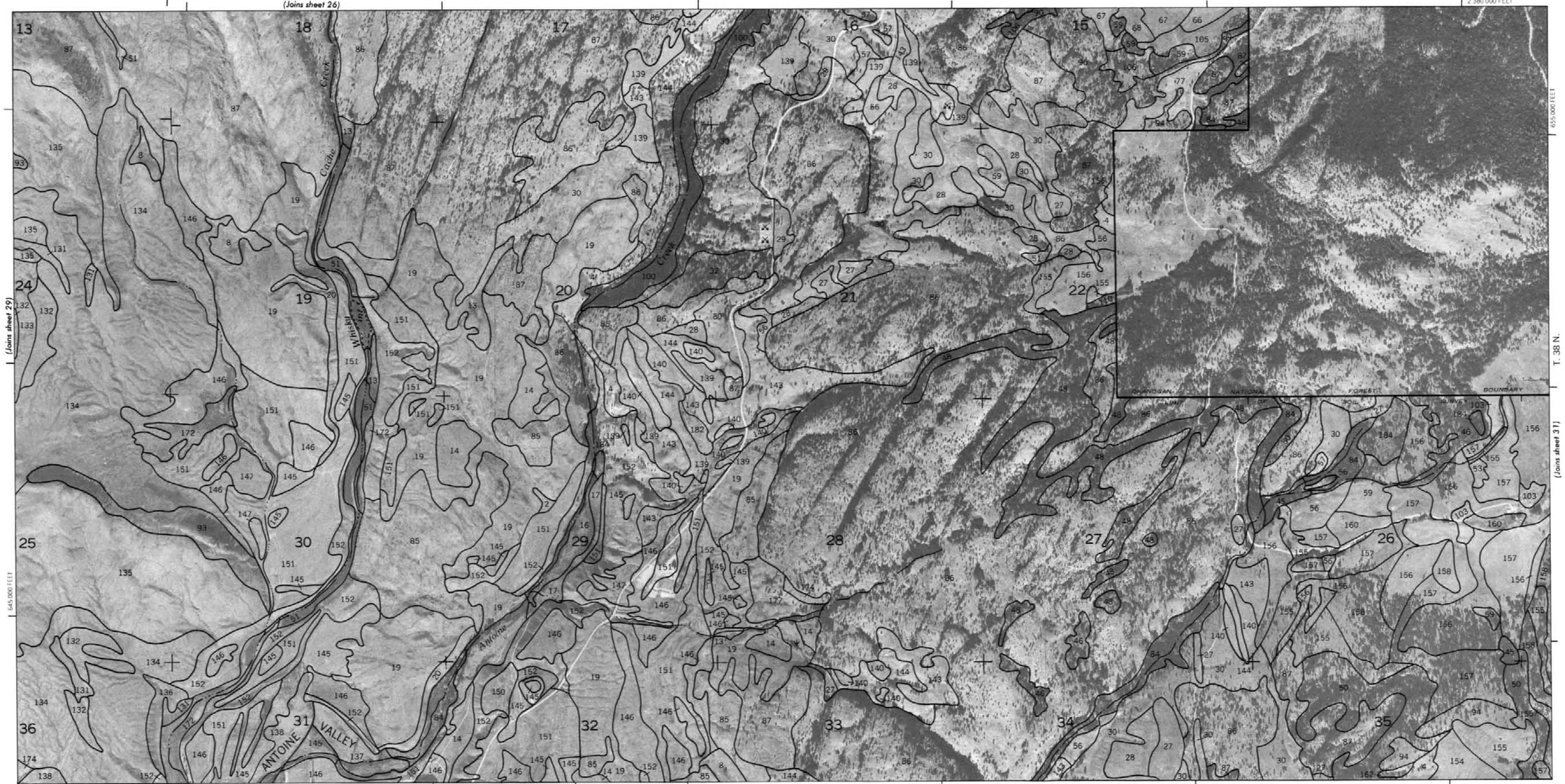
This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:20000

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale · 1 : 20 000

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotographs by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

R. 28 E. | R. 29 E.

2 385 000 FEET

655 000 FEET

T. 38 N.

(Joins sheet 30)

OKANOGAN NATIONAL FOREST BOUNDARY

OKANOGAN LIMIT OF SOIL SURVEY

(Joins inset B, sheet 43)

R. 19 E. | R. 20 E.

2 100 000 FEET

585 000 FEET

T. 36 N.

OKANOGAN LIMIT OF SOIL SURVEY

METHOW

METHOW

Flagg Mountain

NATIONAL

Mazama

VALLEY

RIVER

FOREST

(Joins inset, sheet 48)

2 110 000 FEET

580 000 FEET

(Joins sheet 48)

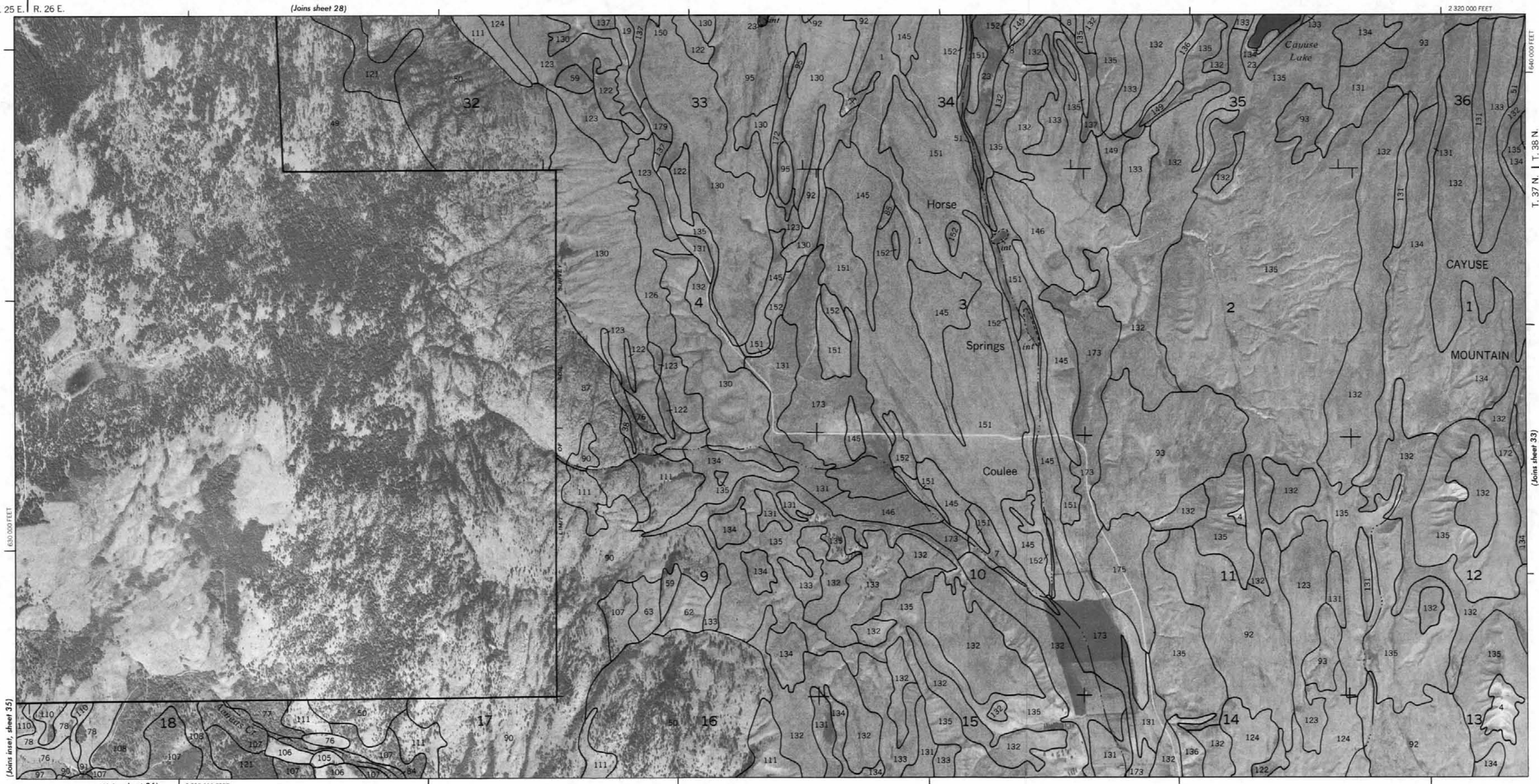
2 410 000 FEET

645 000 FEET

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000



1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

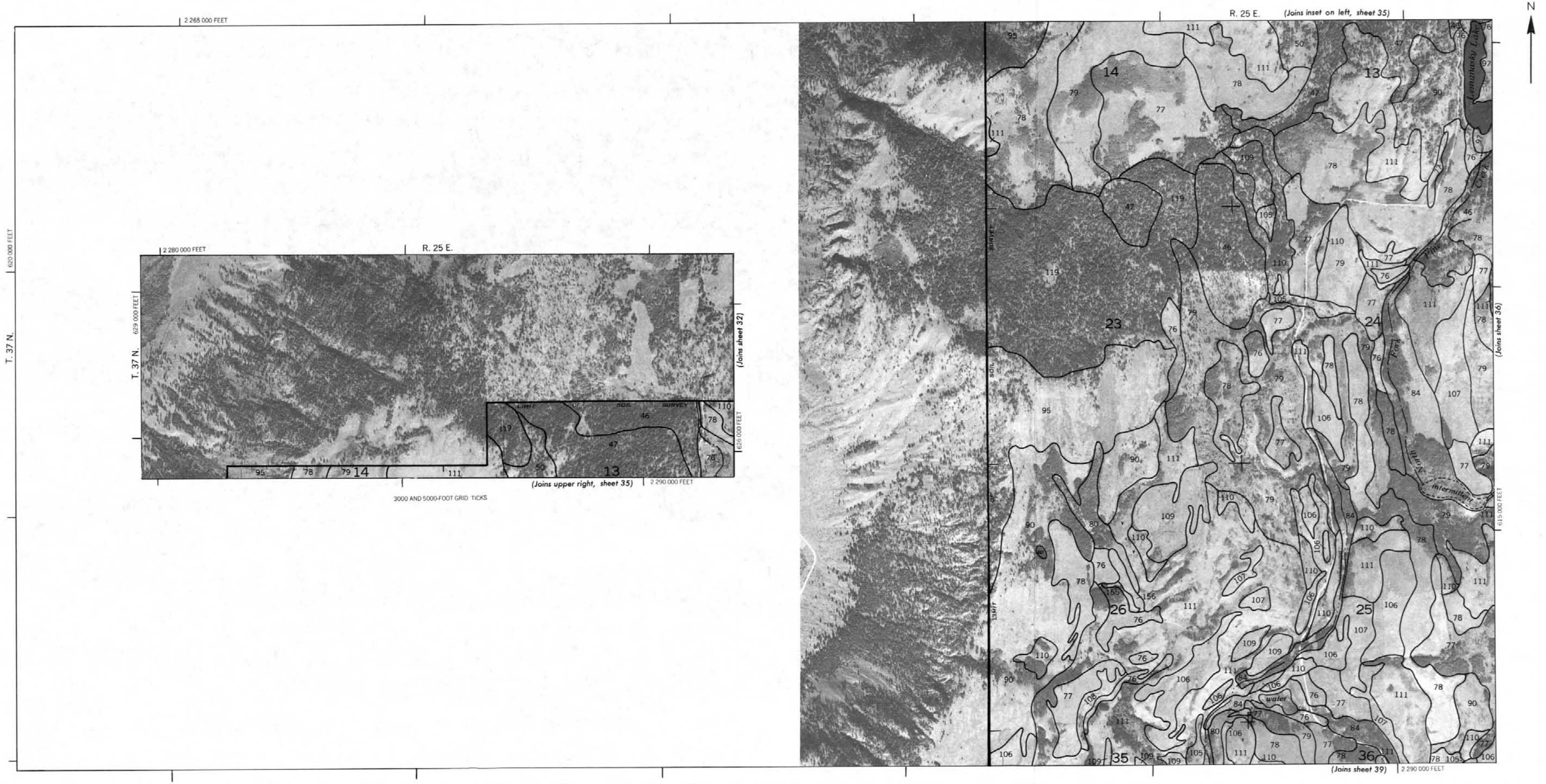
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 34

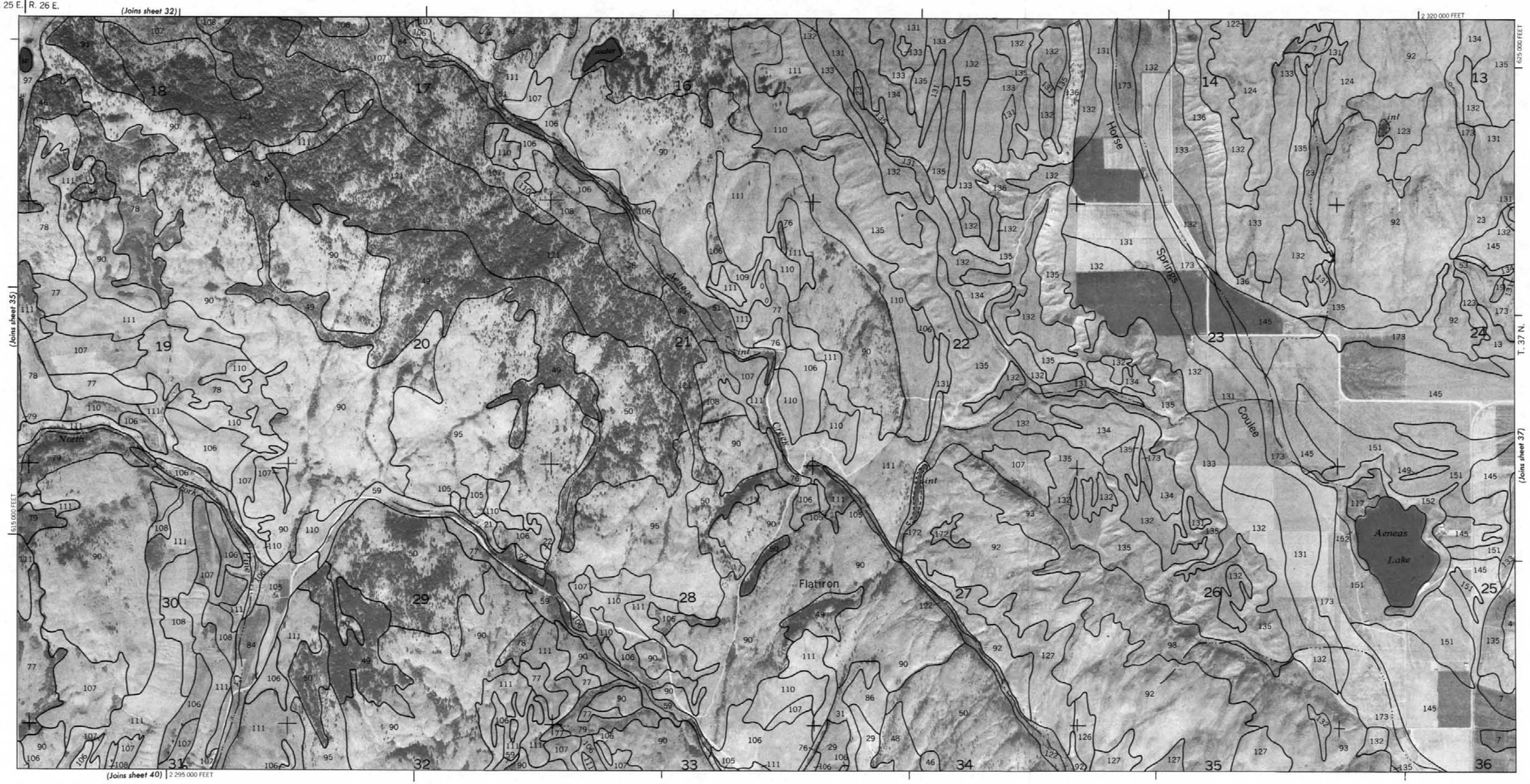
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 ¾ ½ ¼ 0 1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:20000



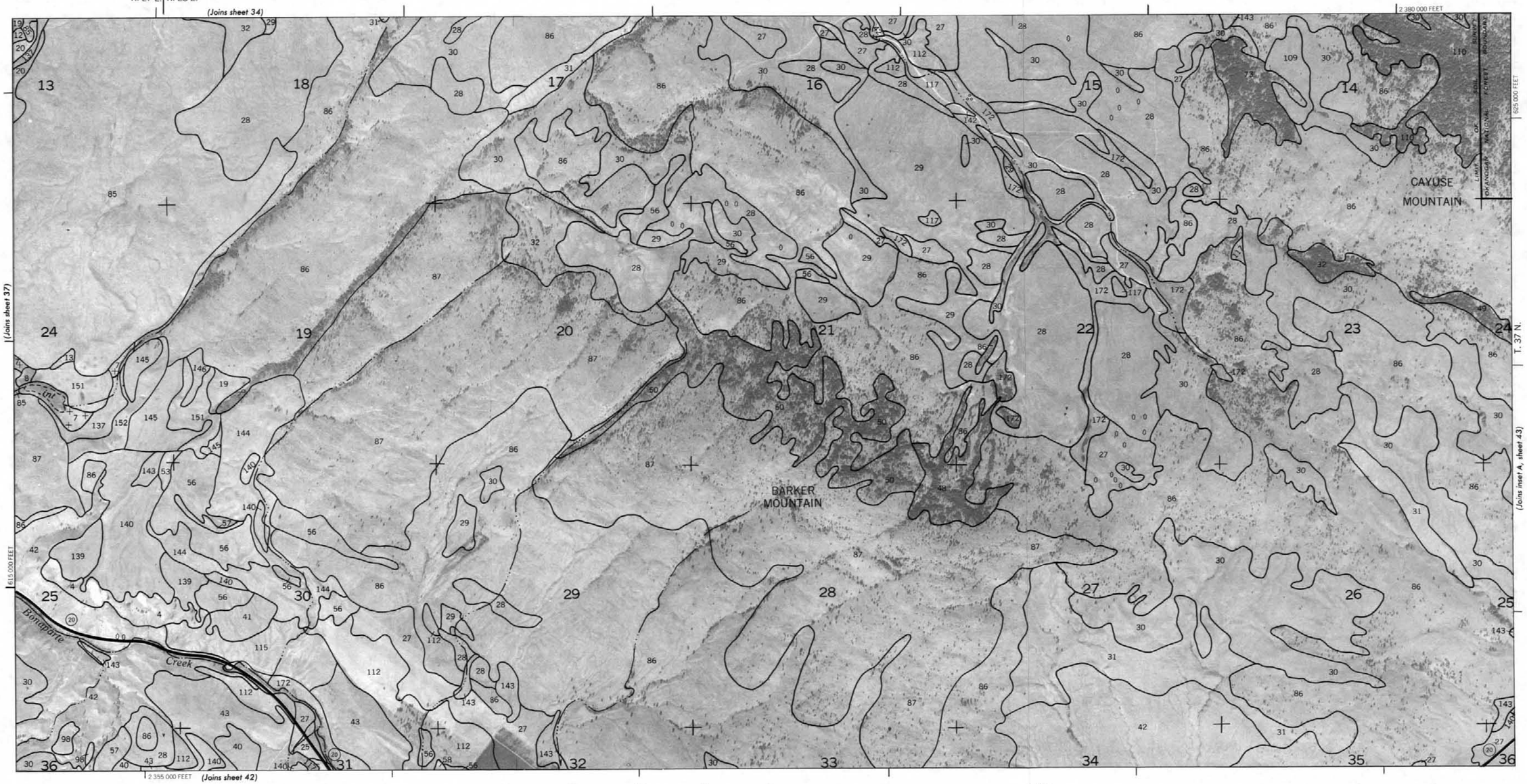
1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale · 1 : 20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



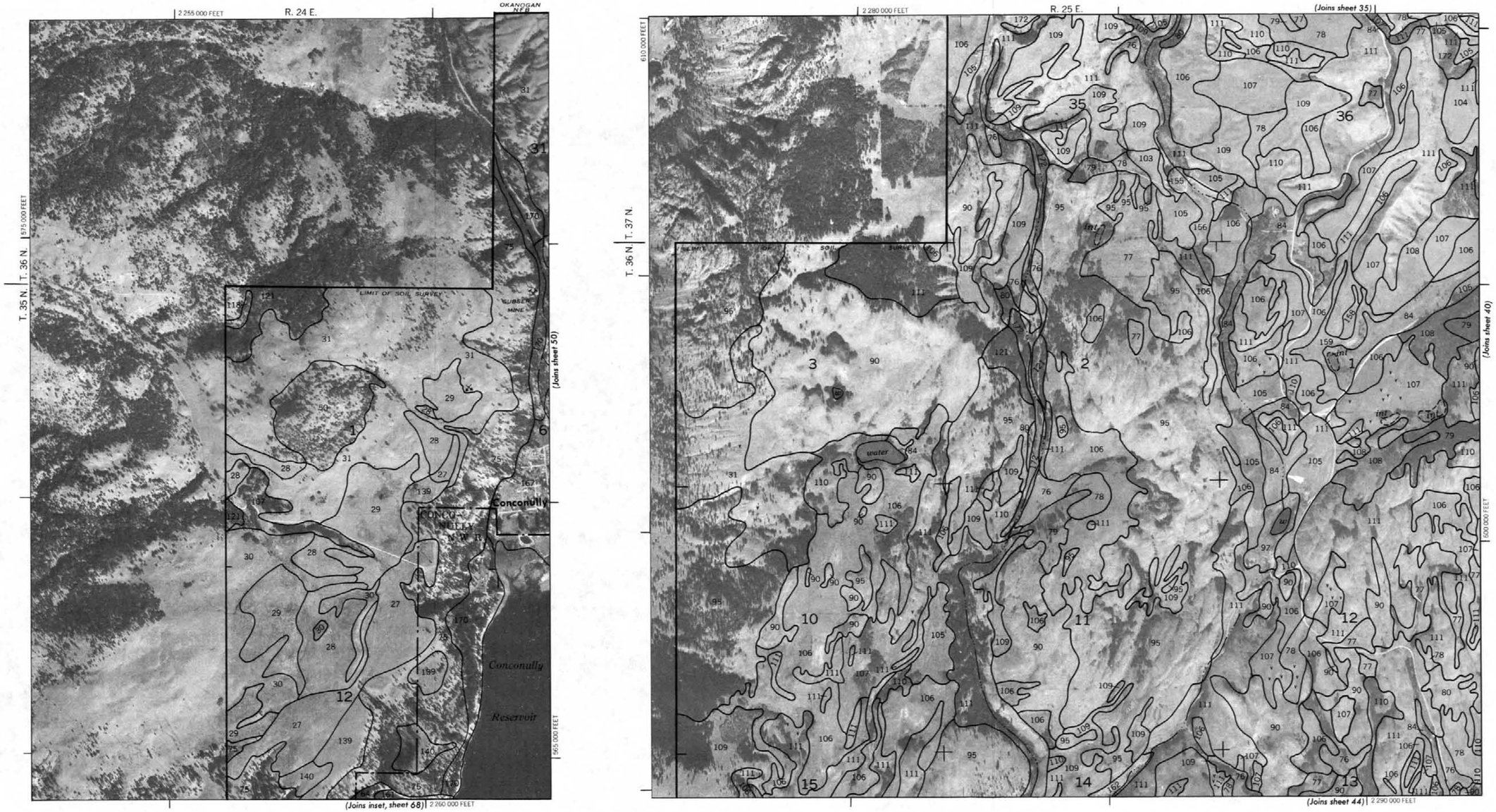
1 Mile

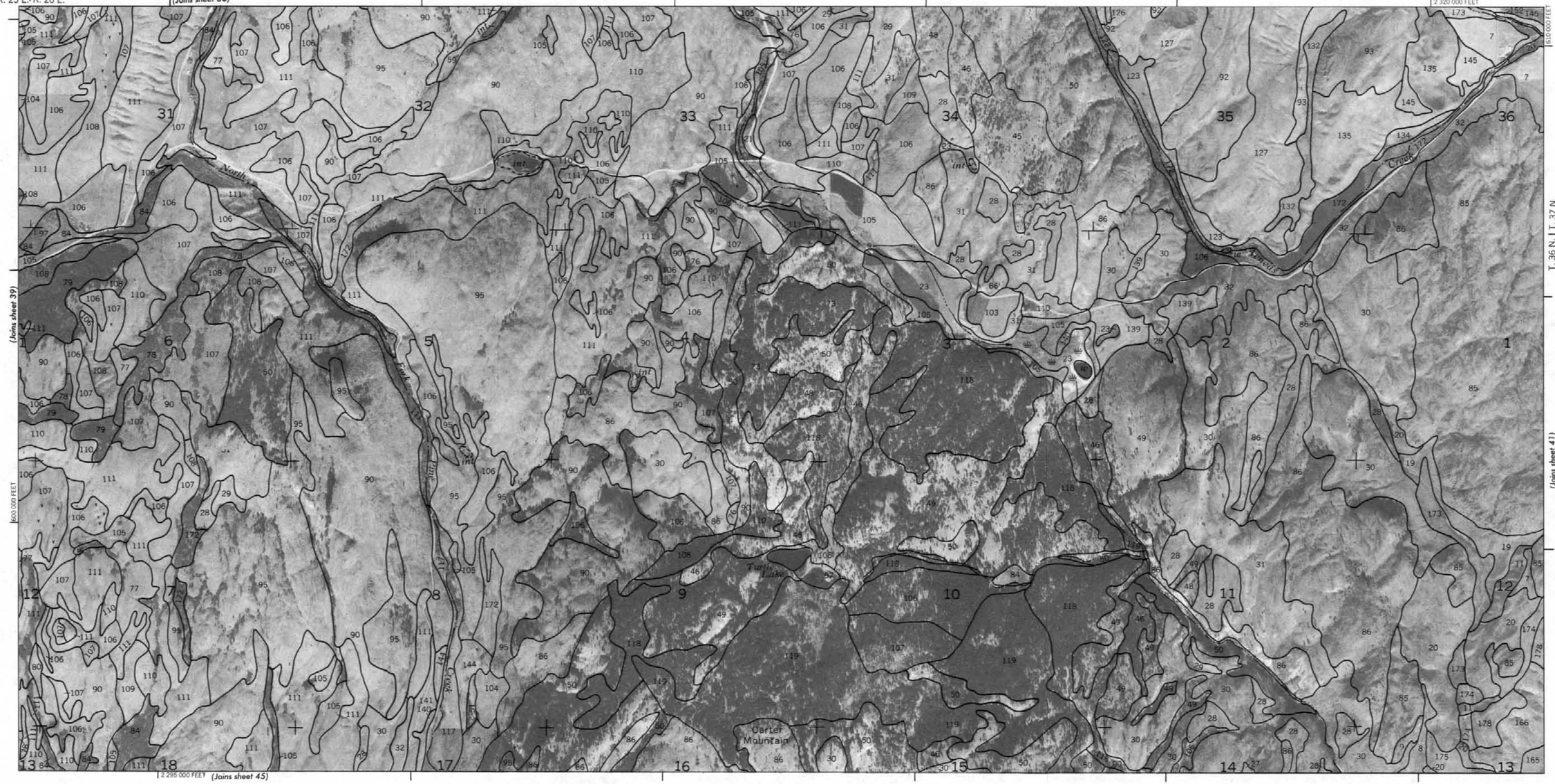
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.





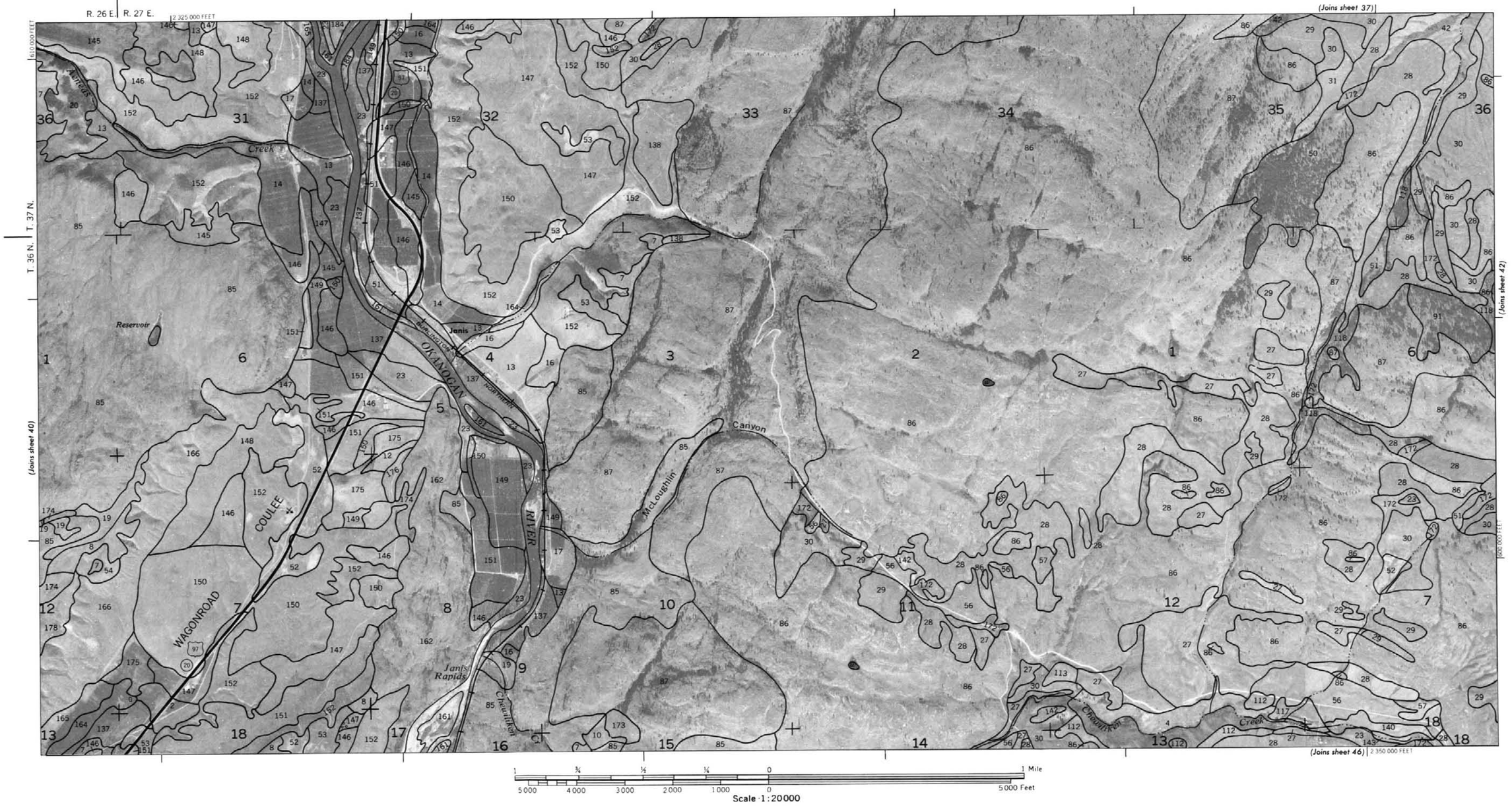
1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale · 1 : 20000

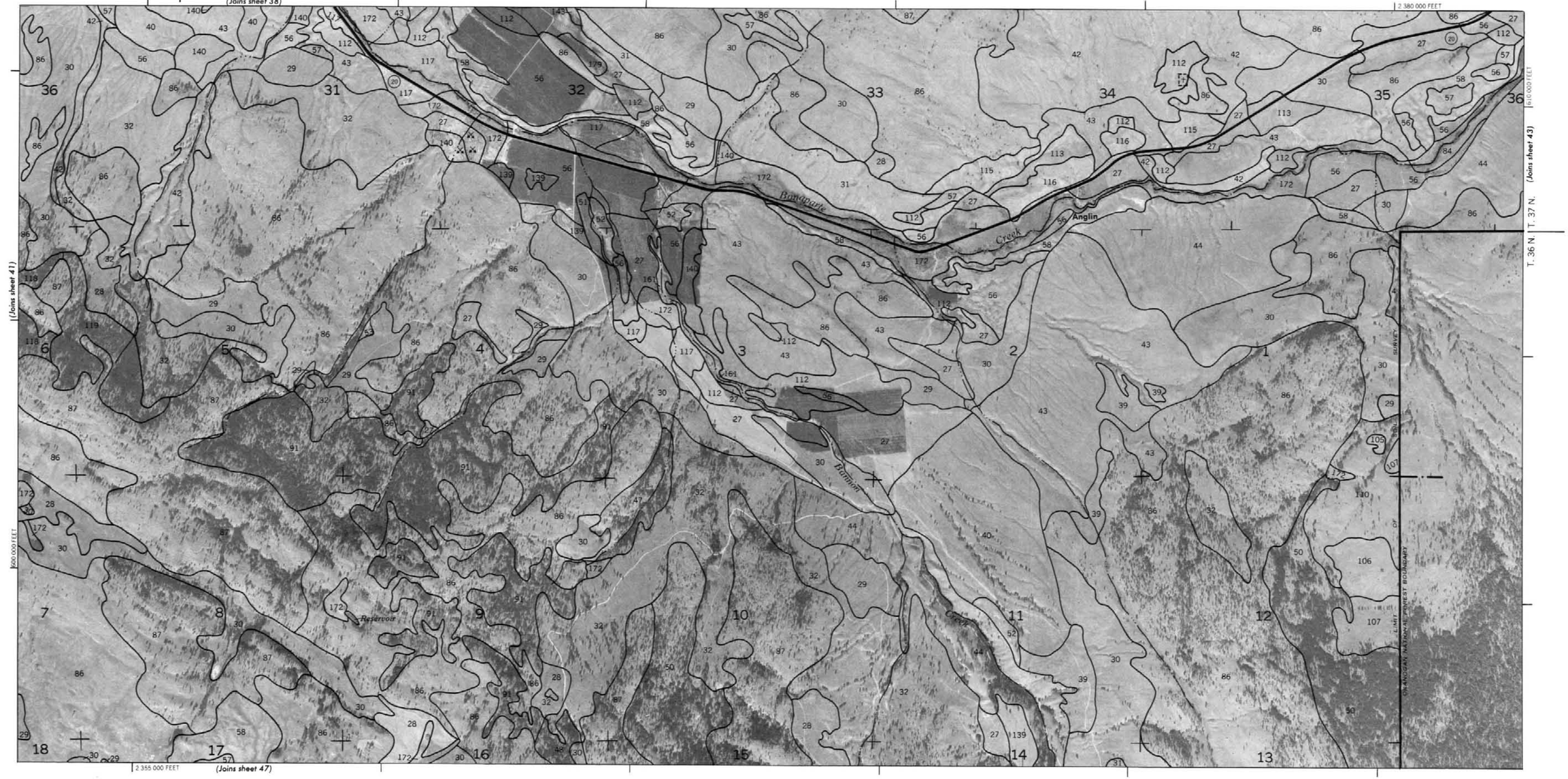
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



This map was compiled on 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

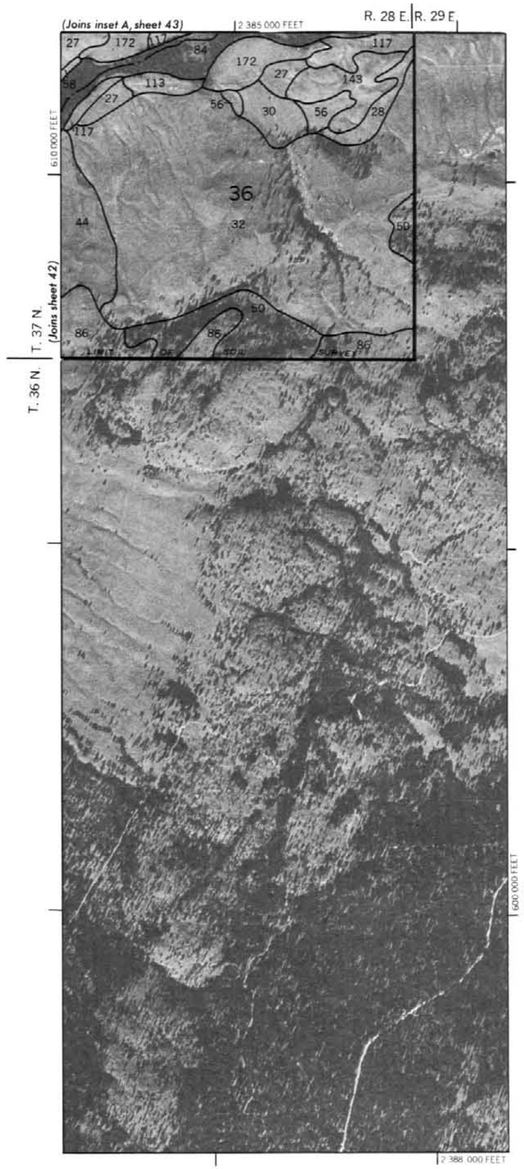
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 42

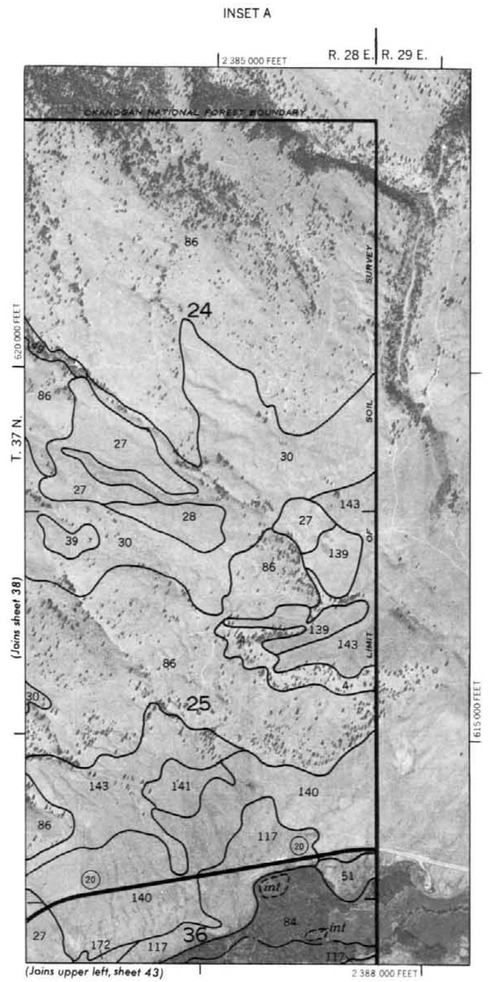


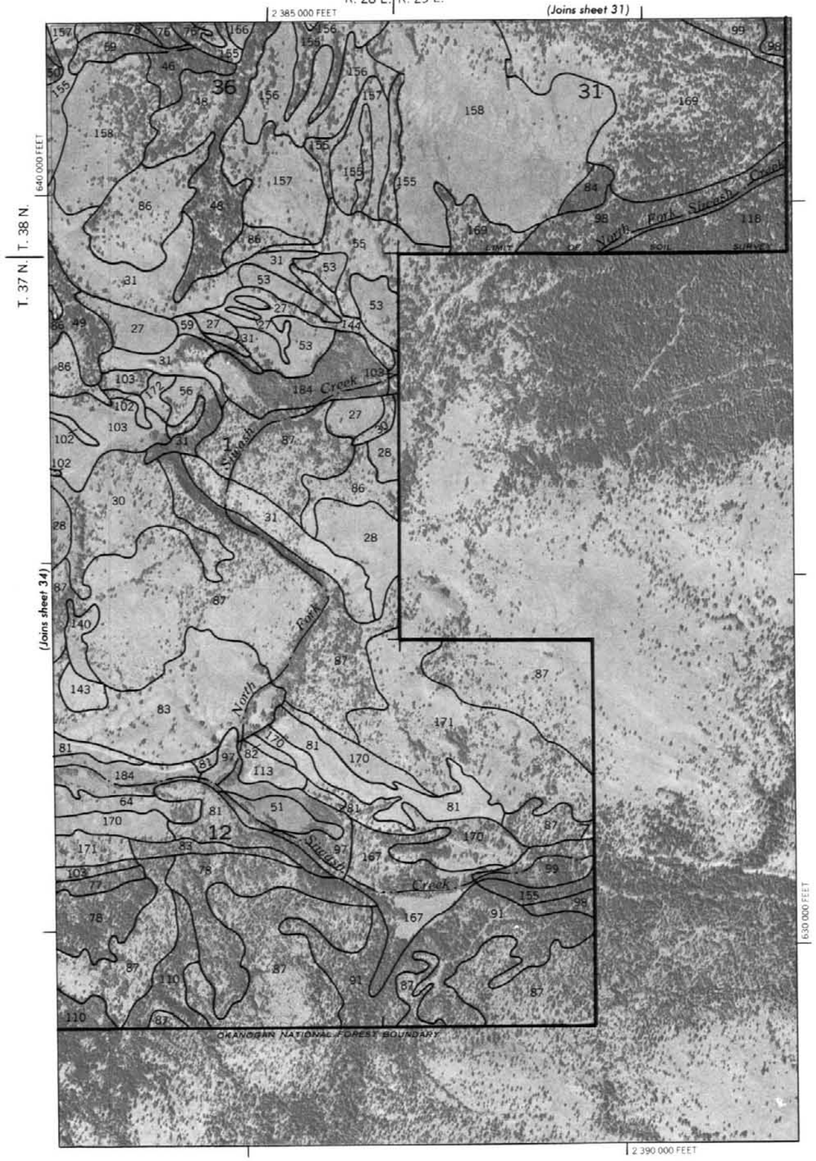
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned







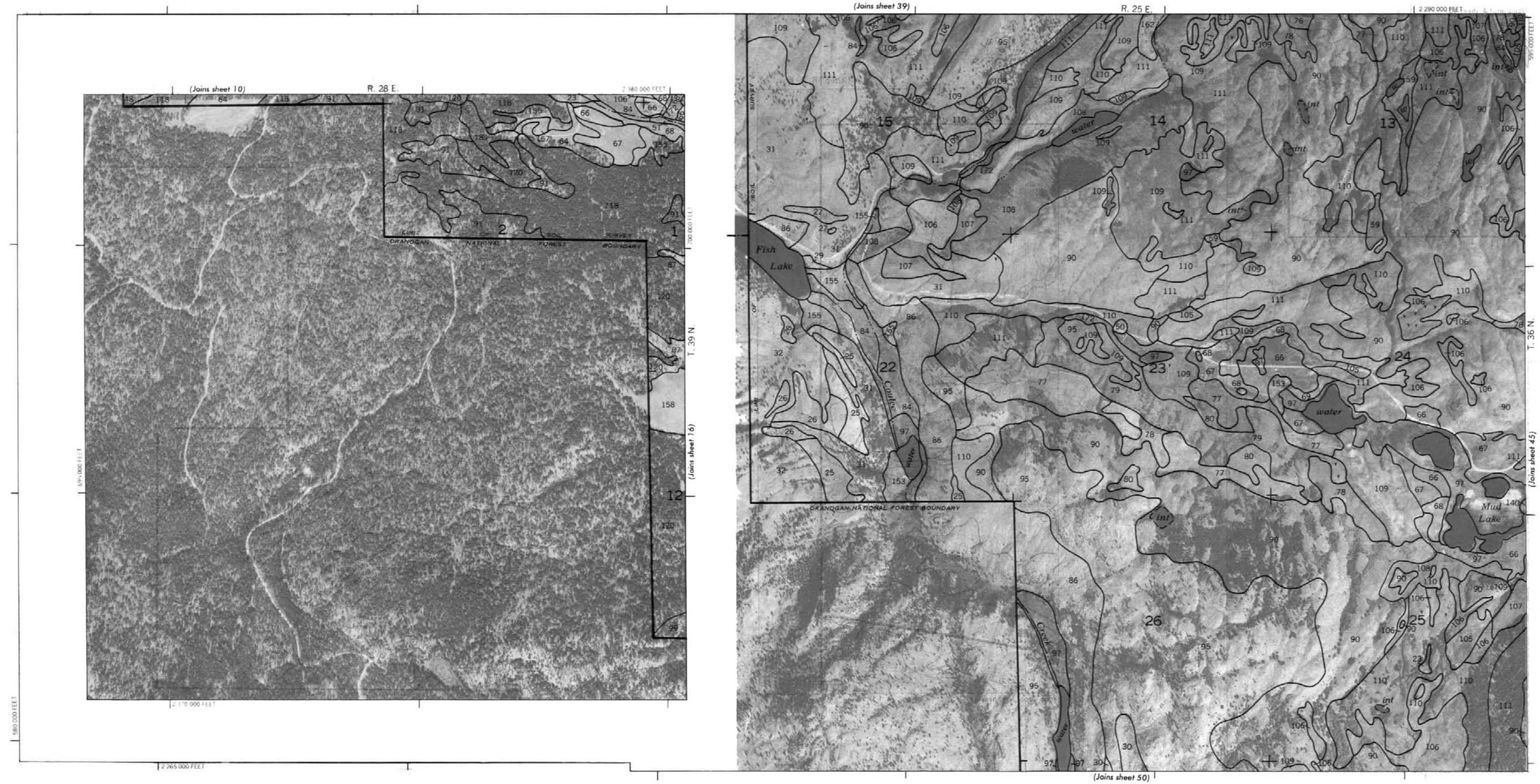
1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000

N

N



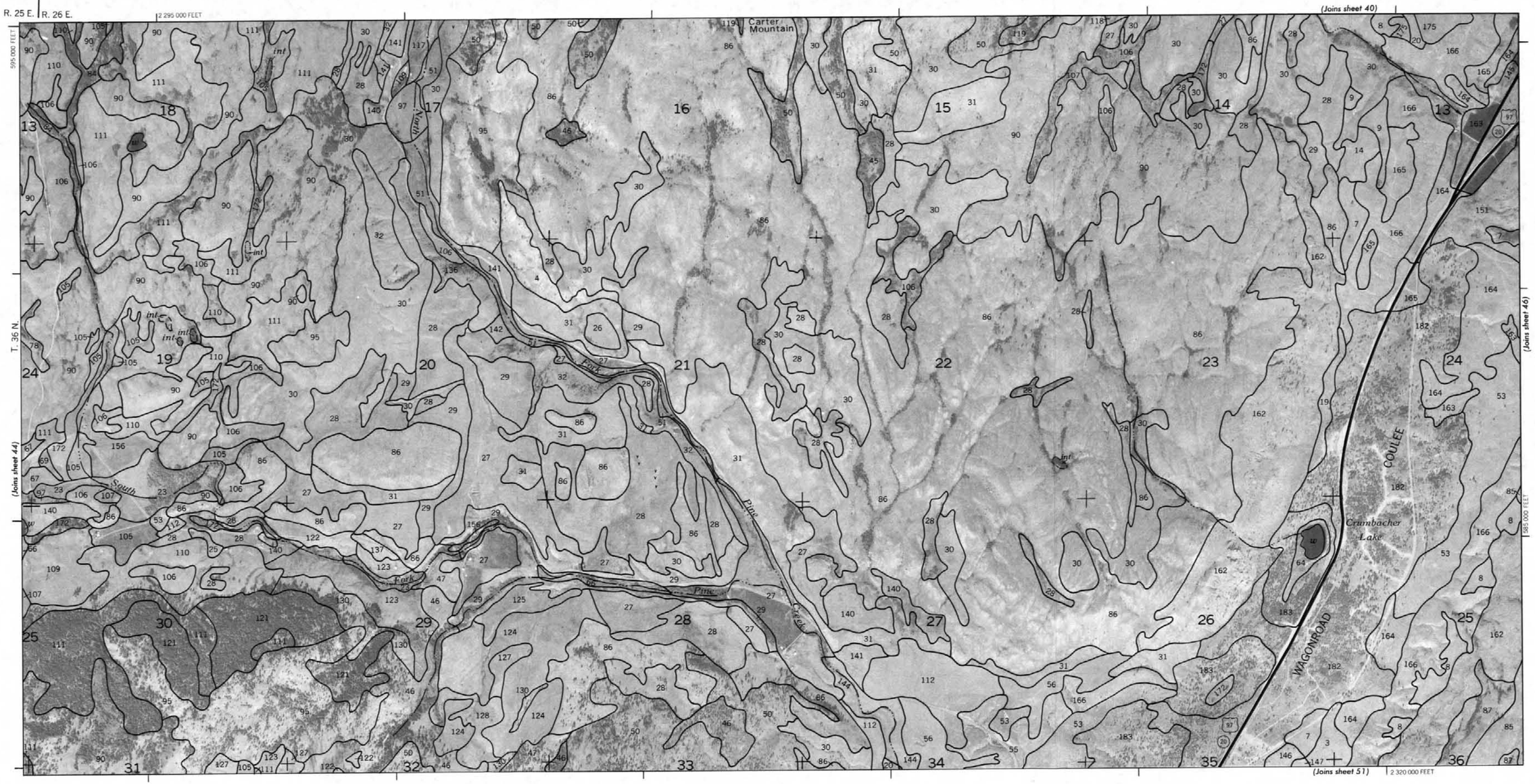
1 ⅜ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

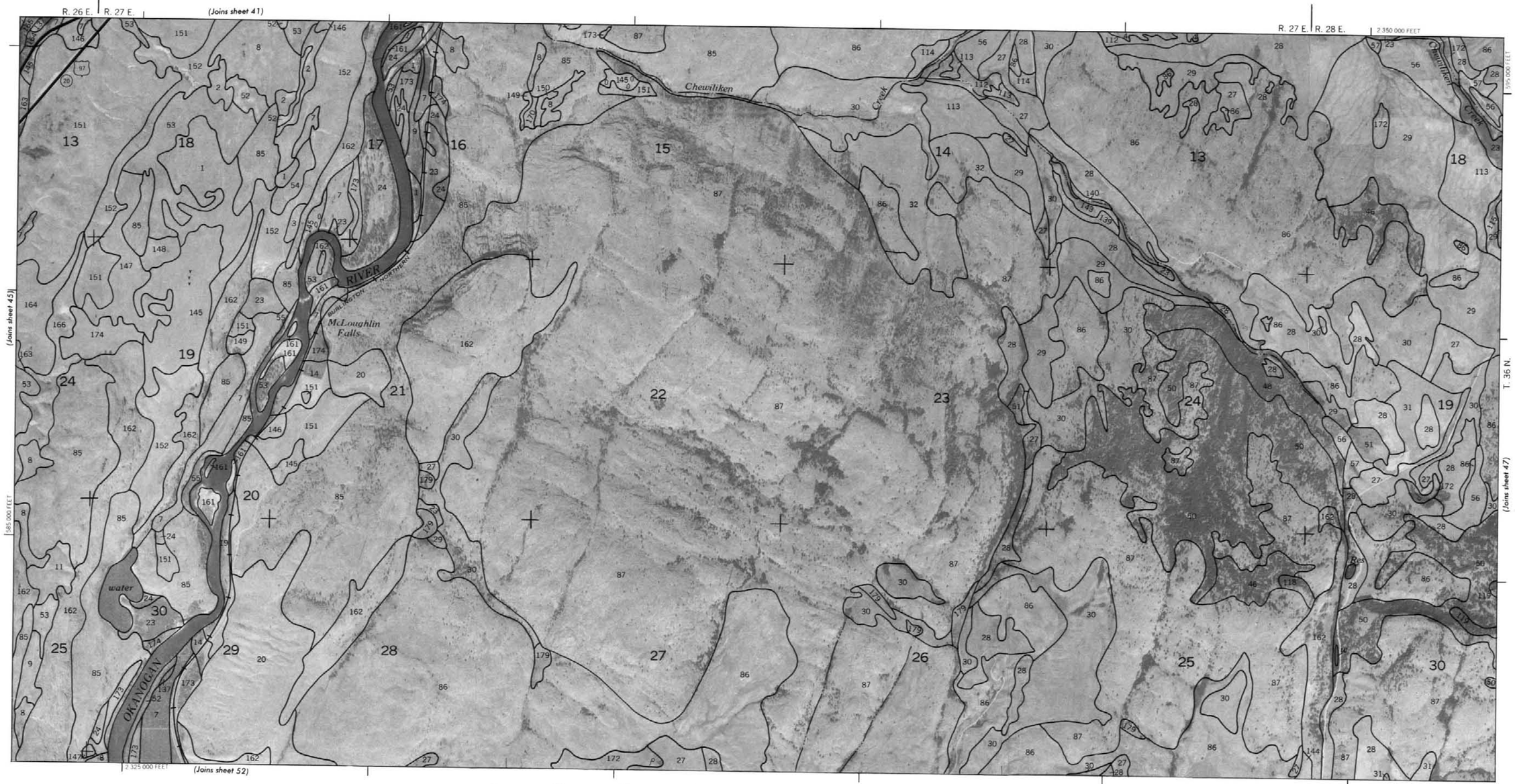
Scale 1:20000

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U S Department of The Interior, Geological Survey orthophotography by the U S Department of Agriculture, Soil Conservation Service and cooperating agencies



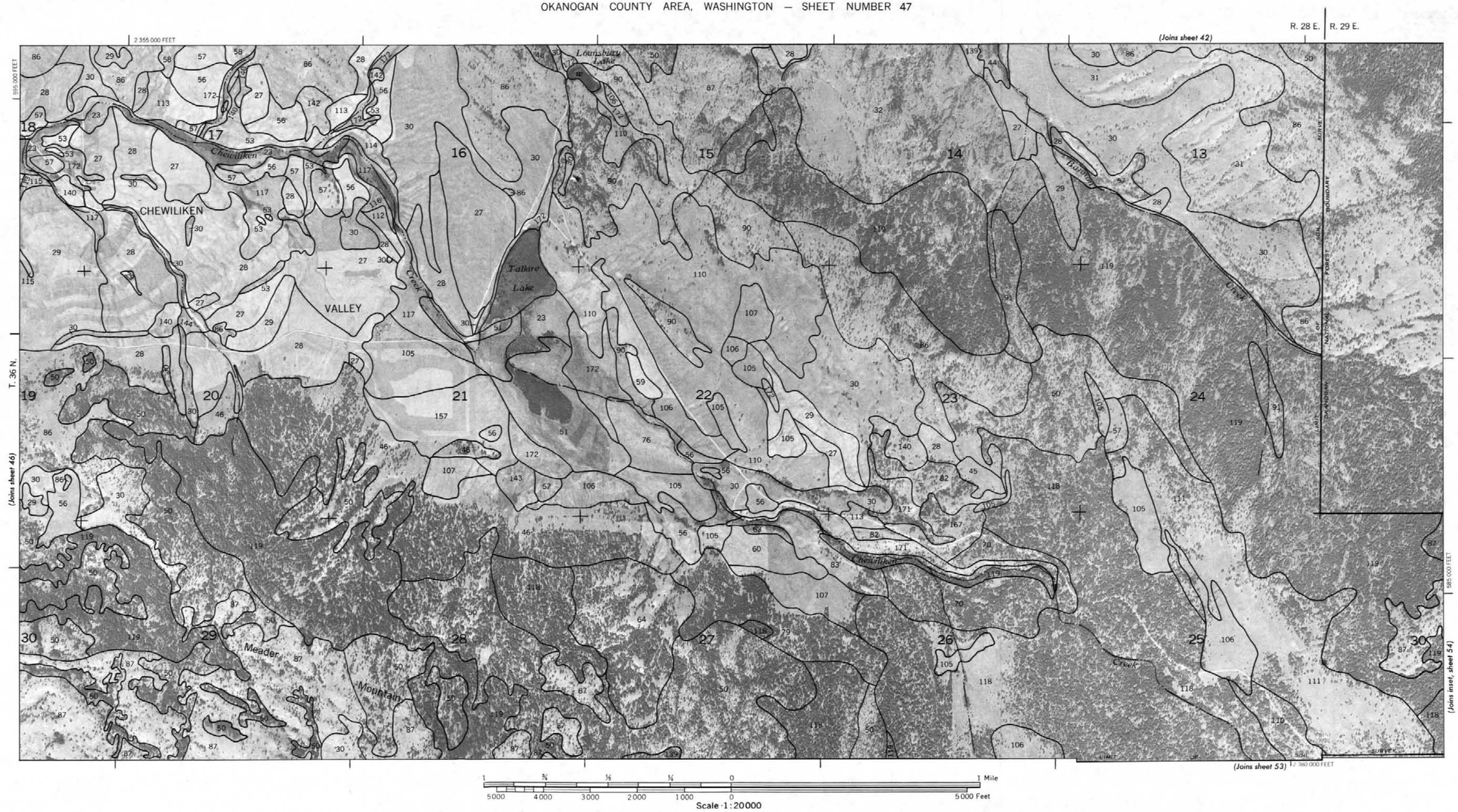
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 46

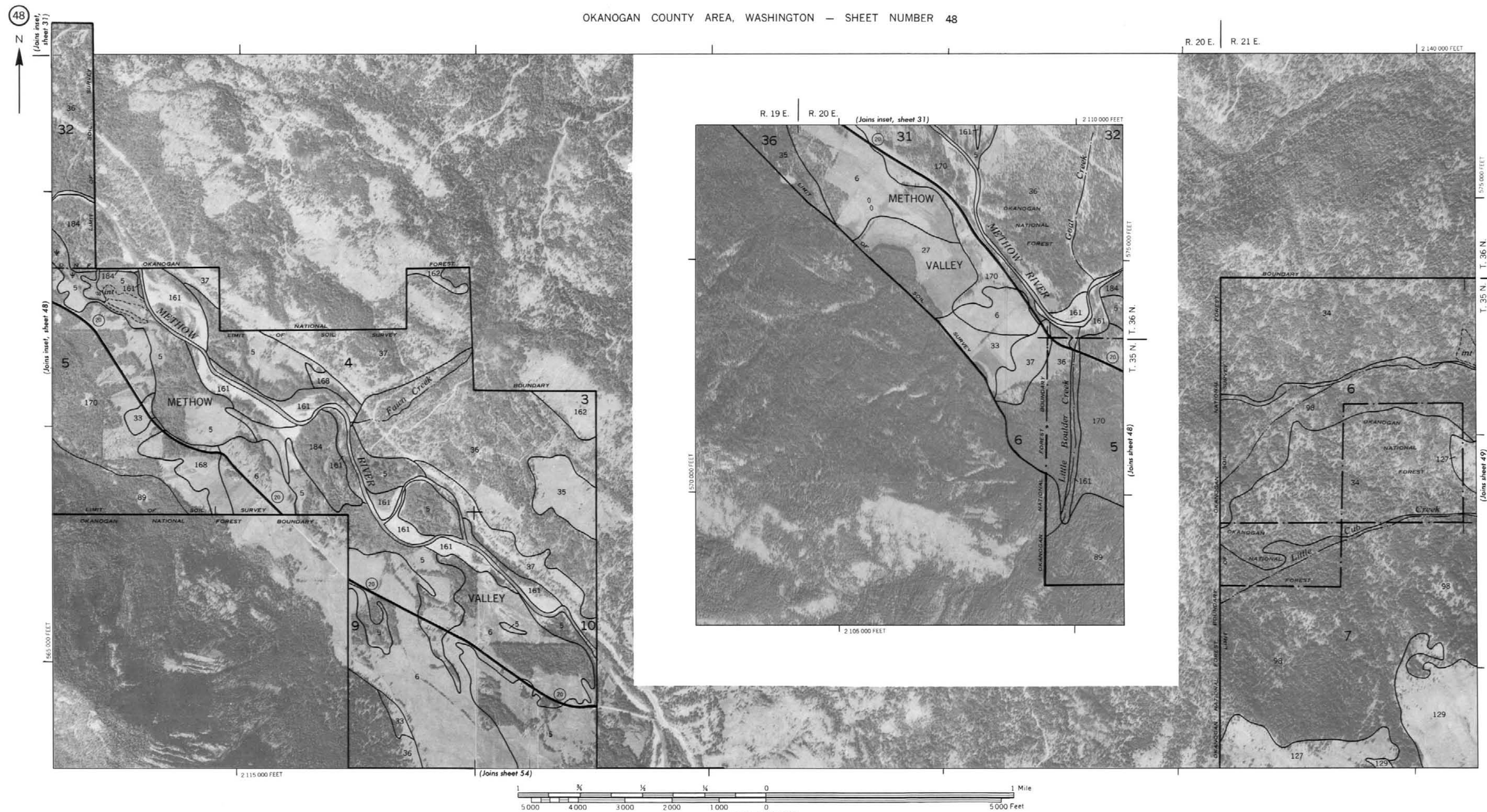


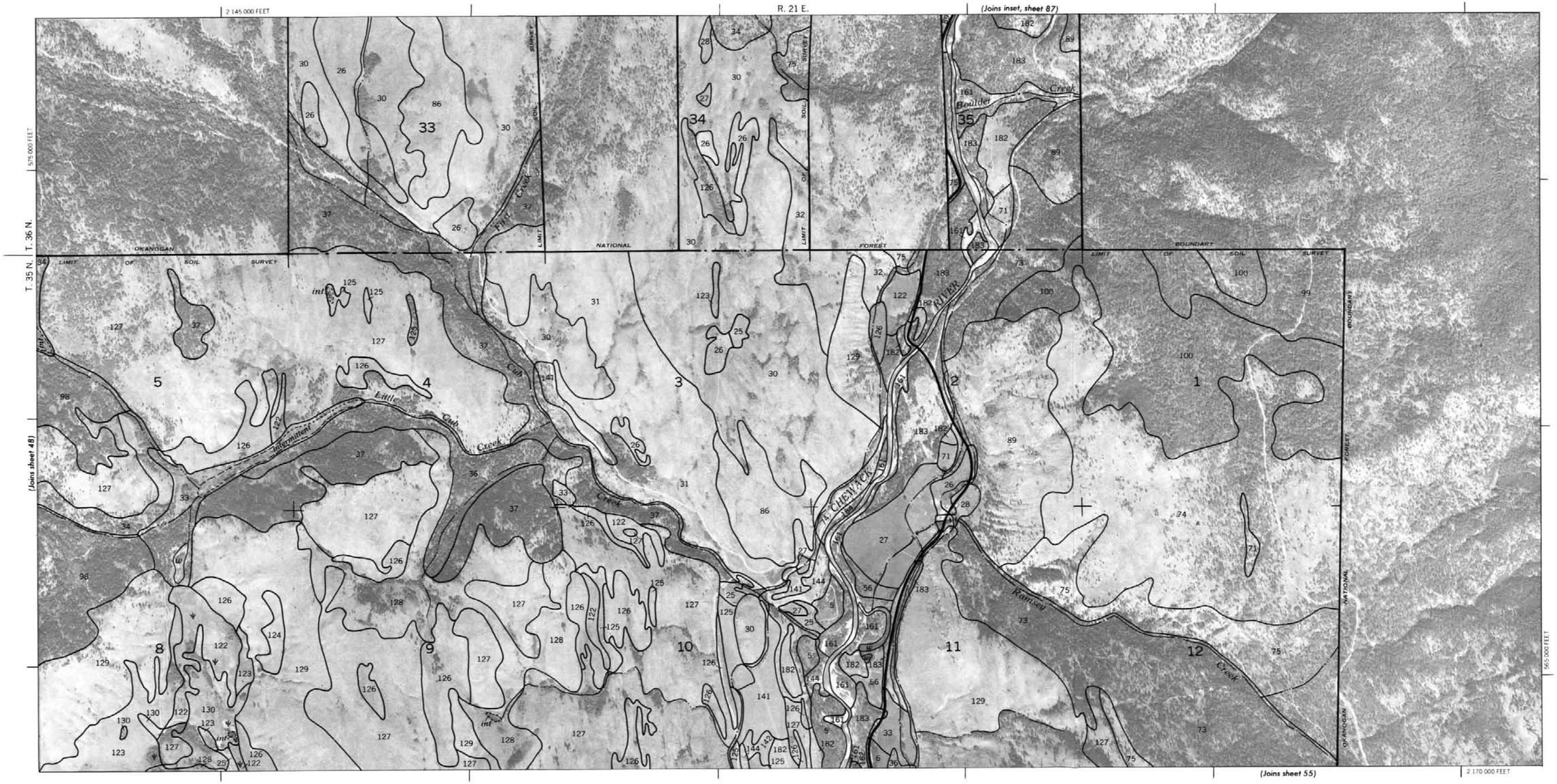
1 Mile
5 000 Feet
Scale 1:20000

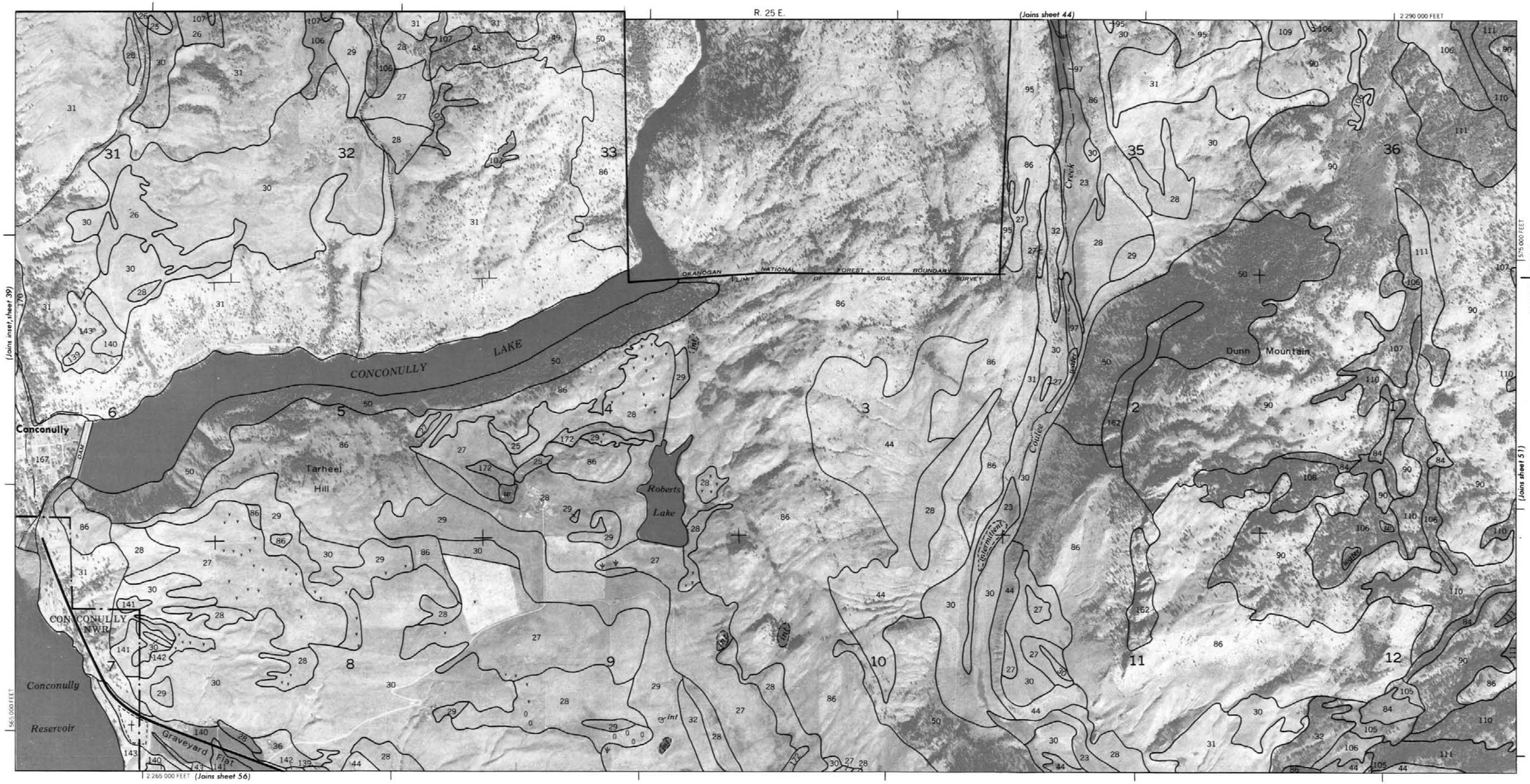
5 000 feet grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



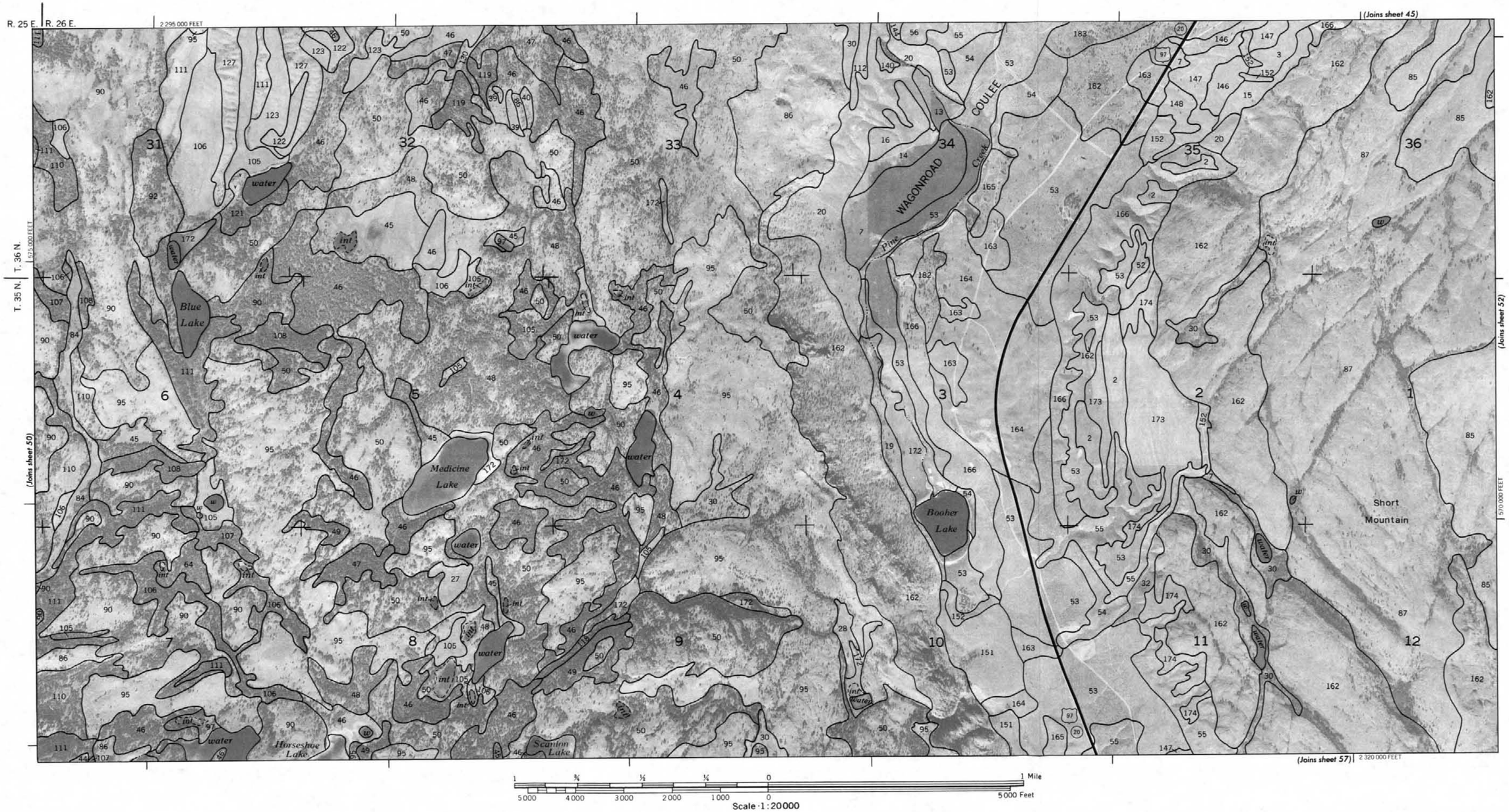




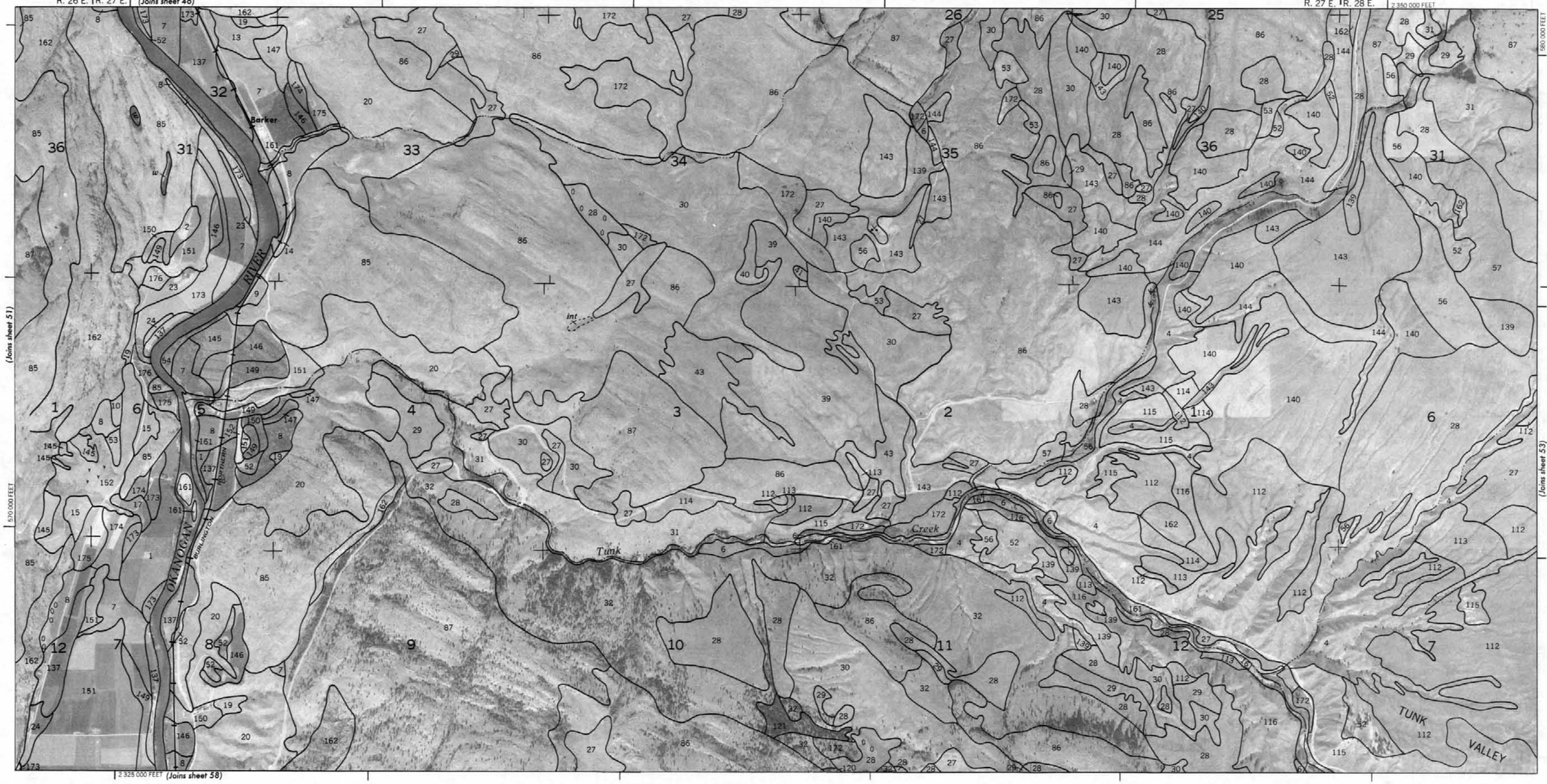


5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies



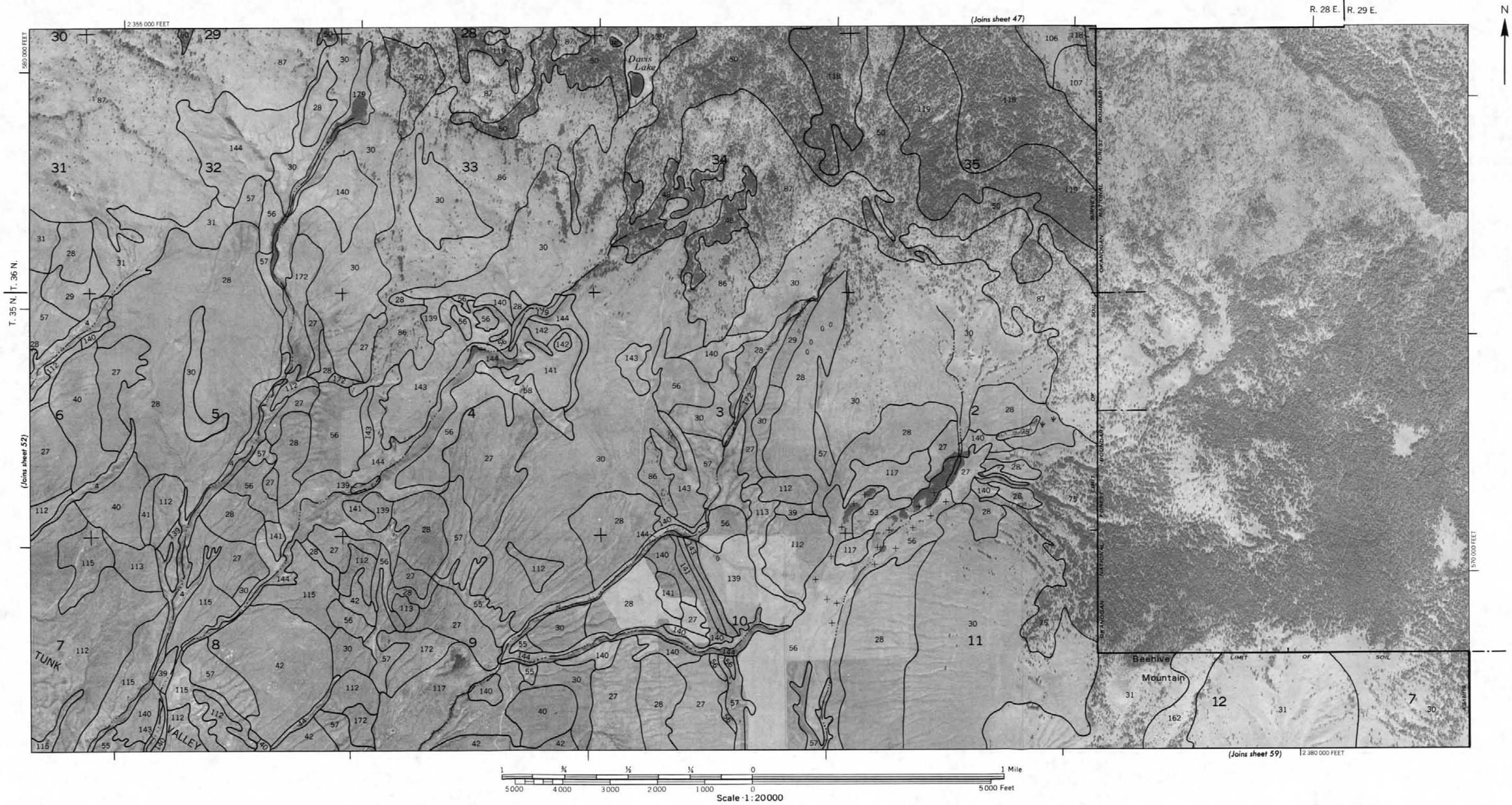
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 52

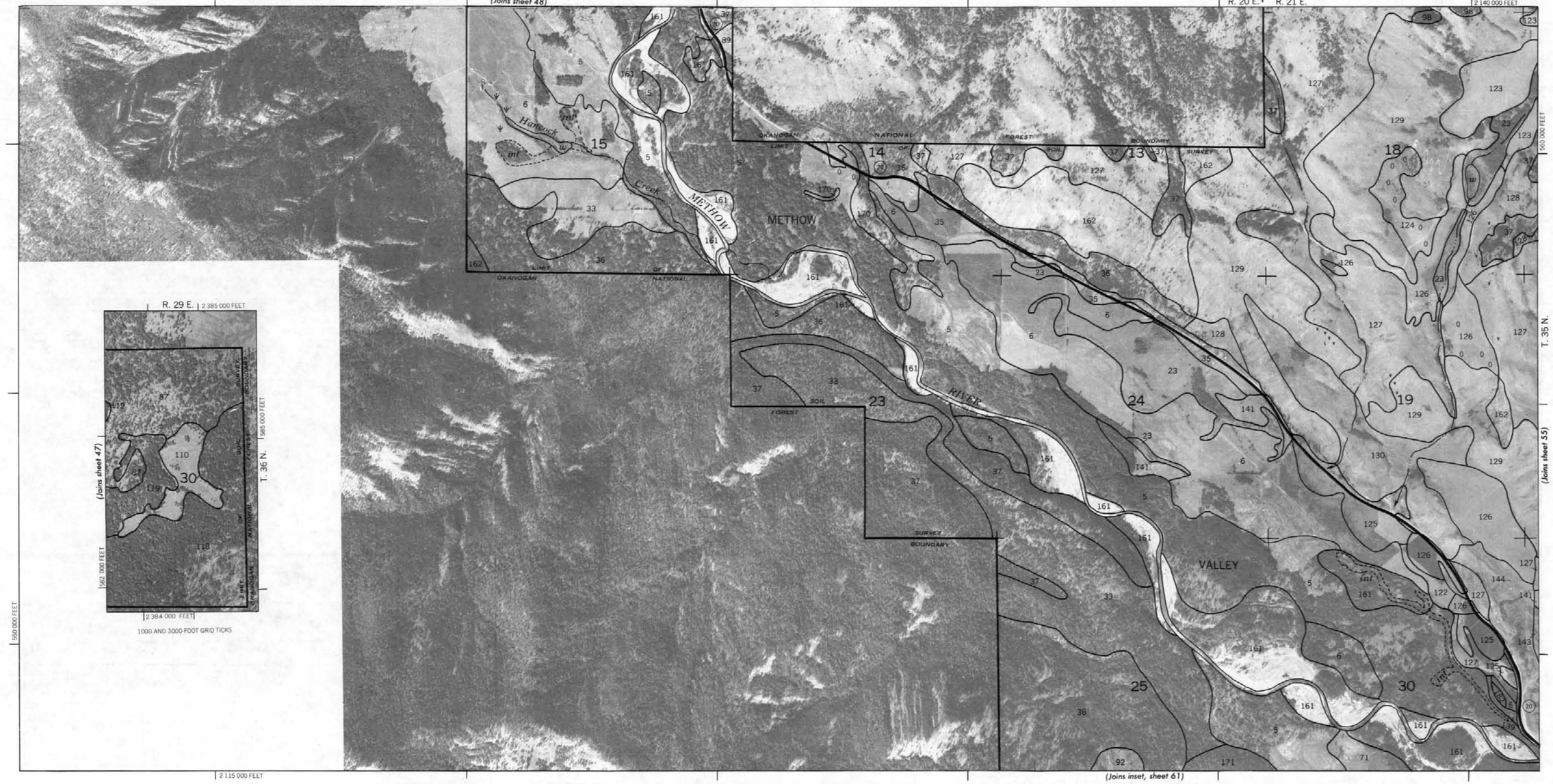


1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:20000

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.





5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

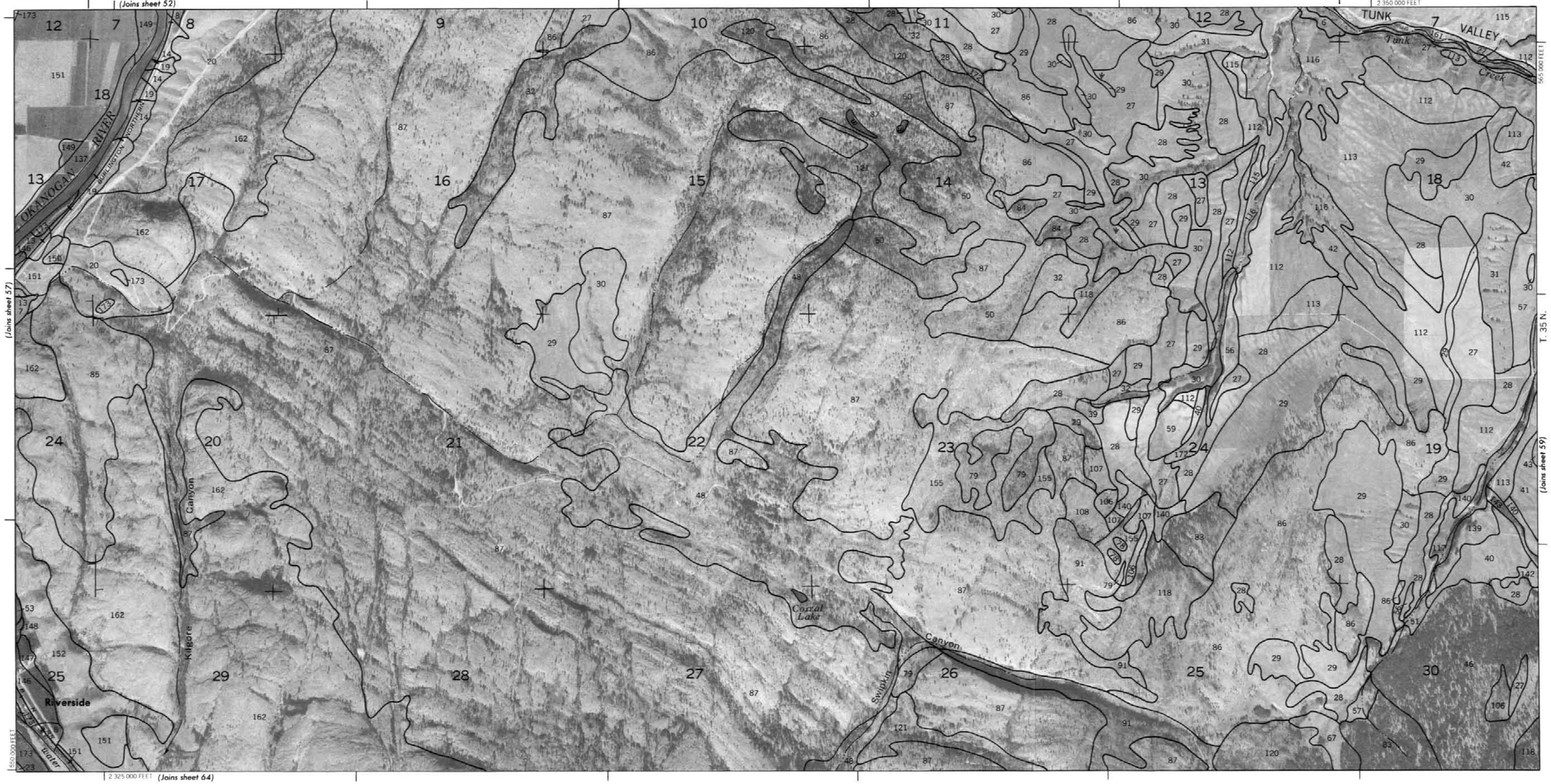
This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 ¾ ½ ¼ 0 1 Mile

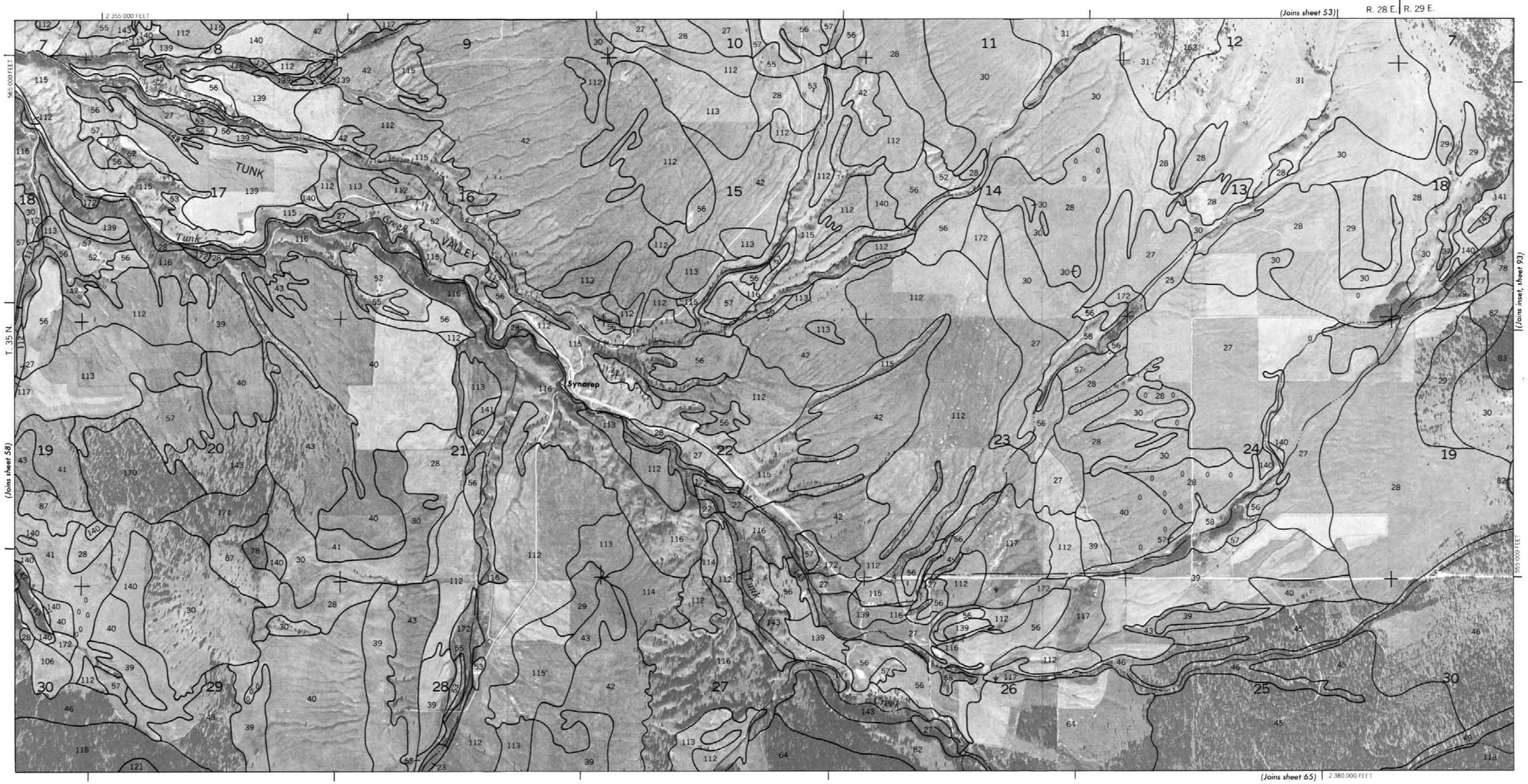
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000



5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

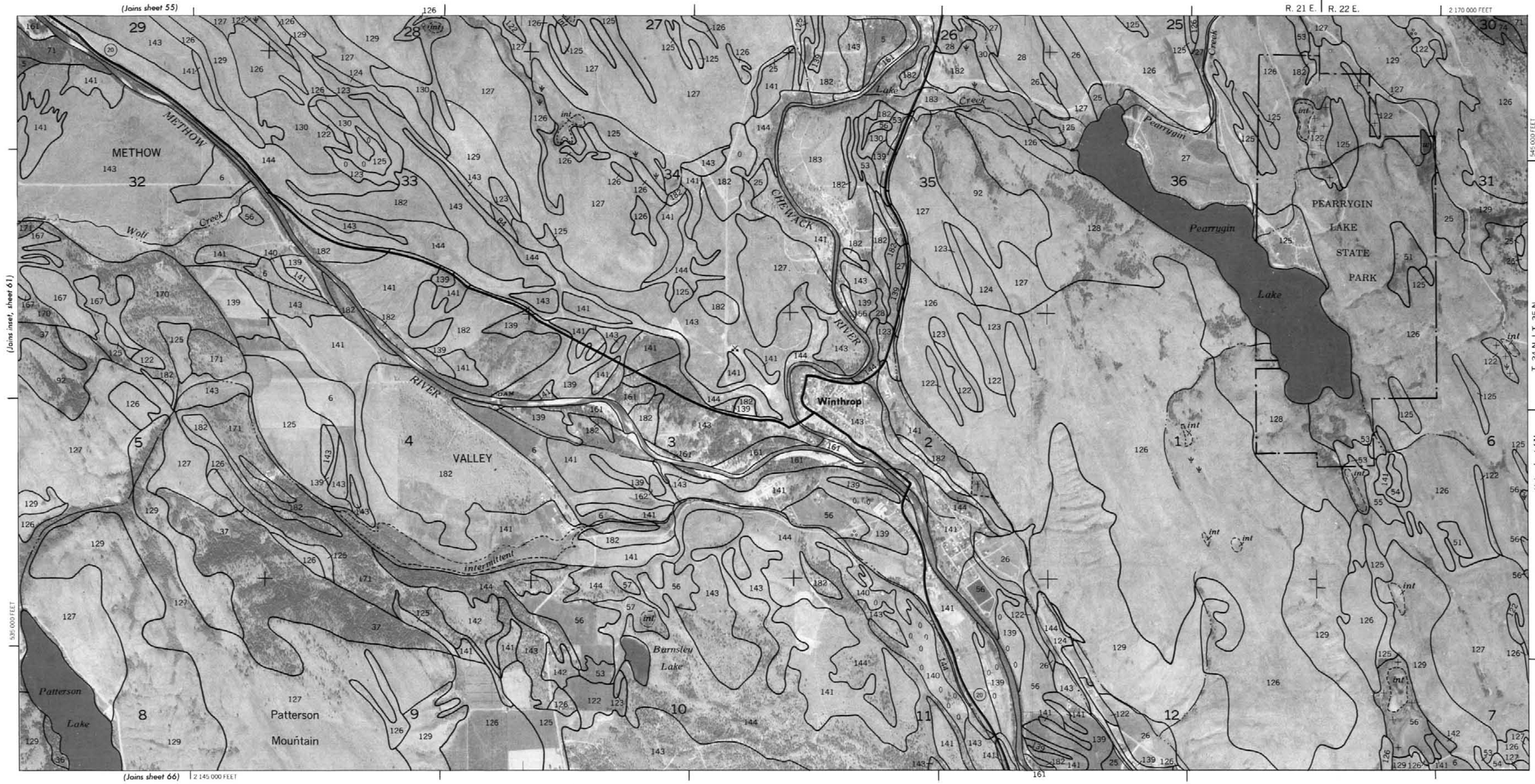
This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000



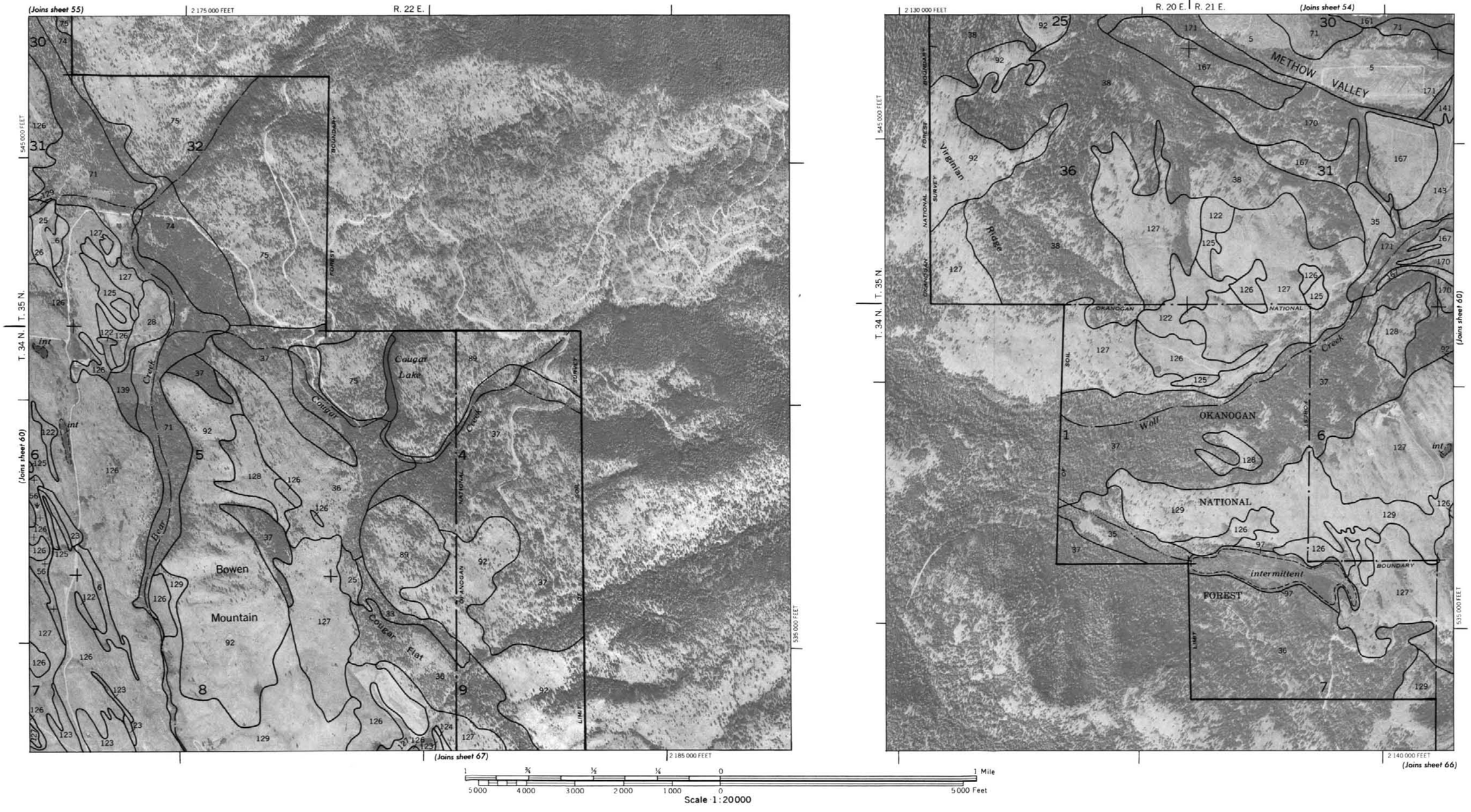
1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies



This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

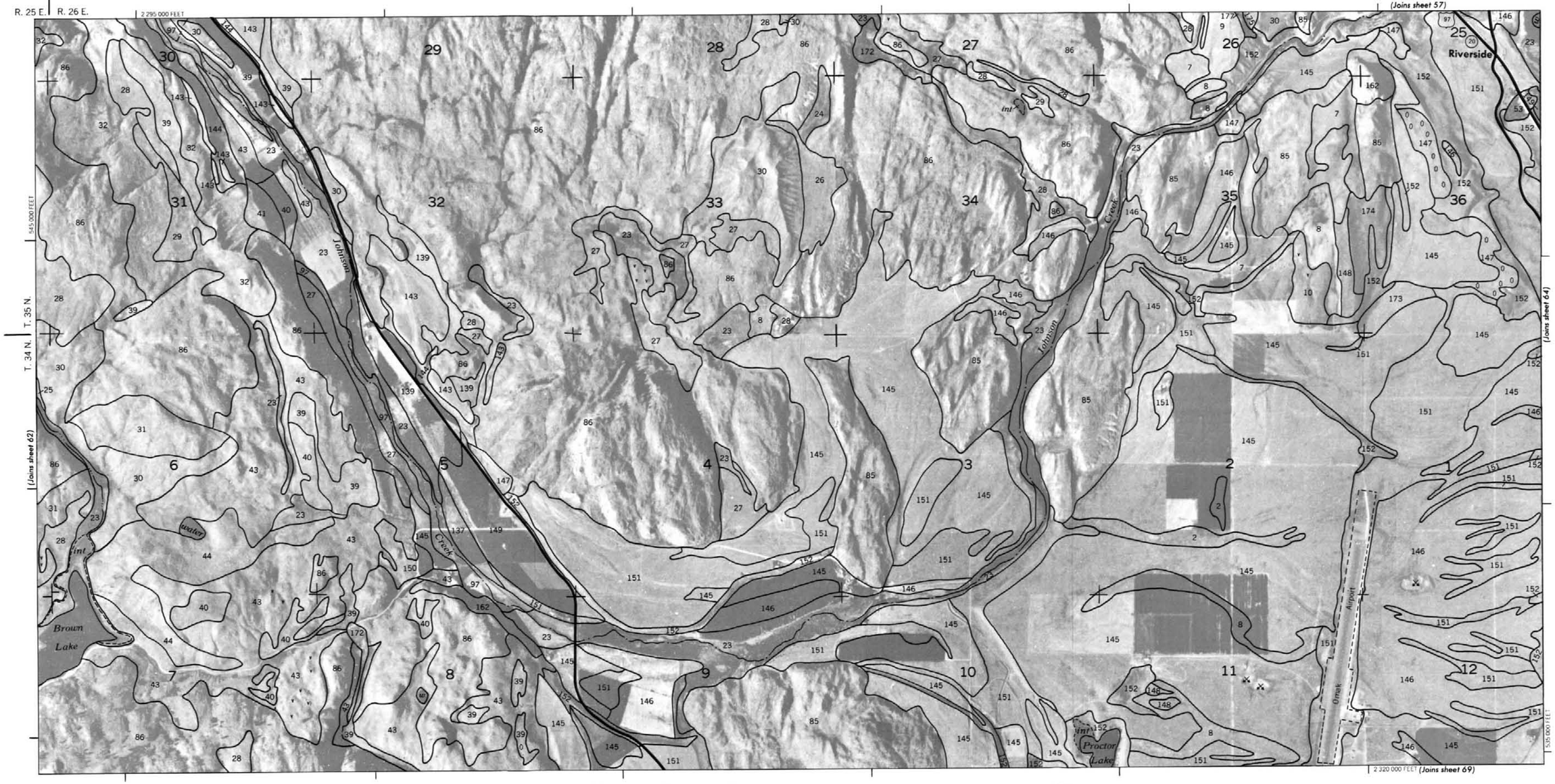
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 62

1 Mile
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000

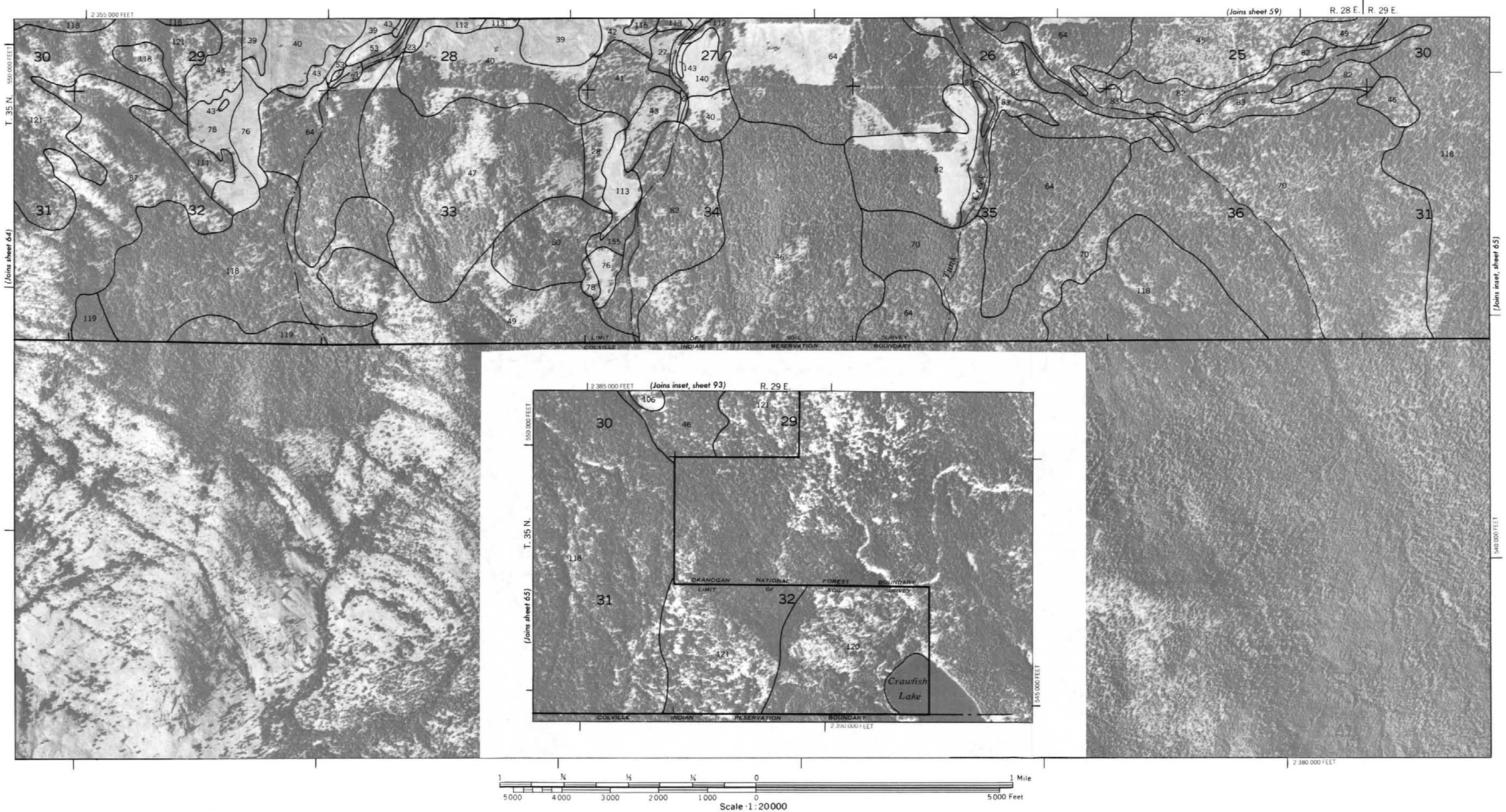
This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

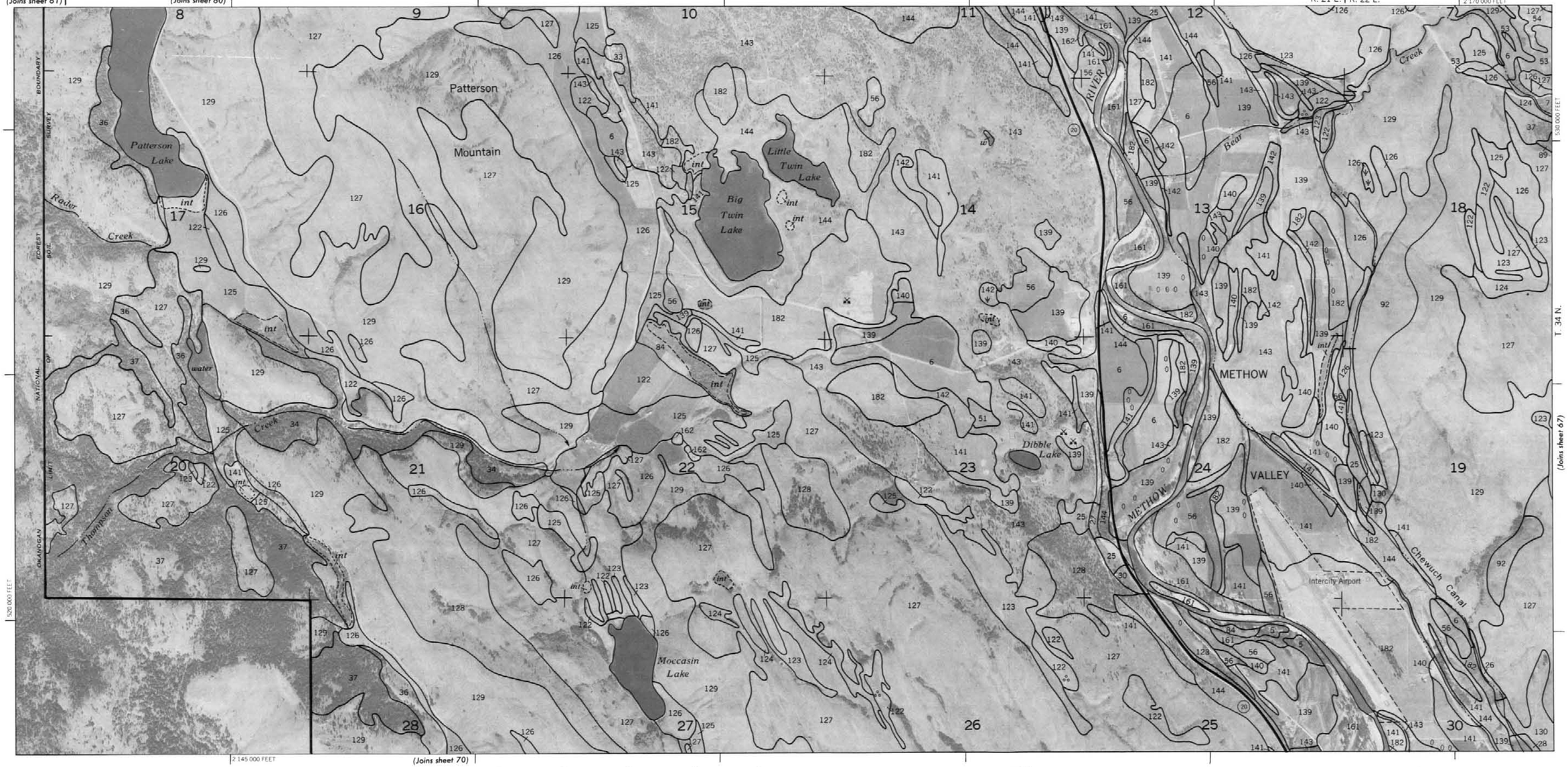
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

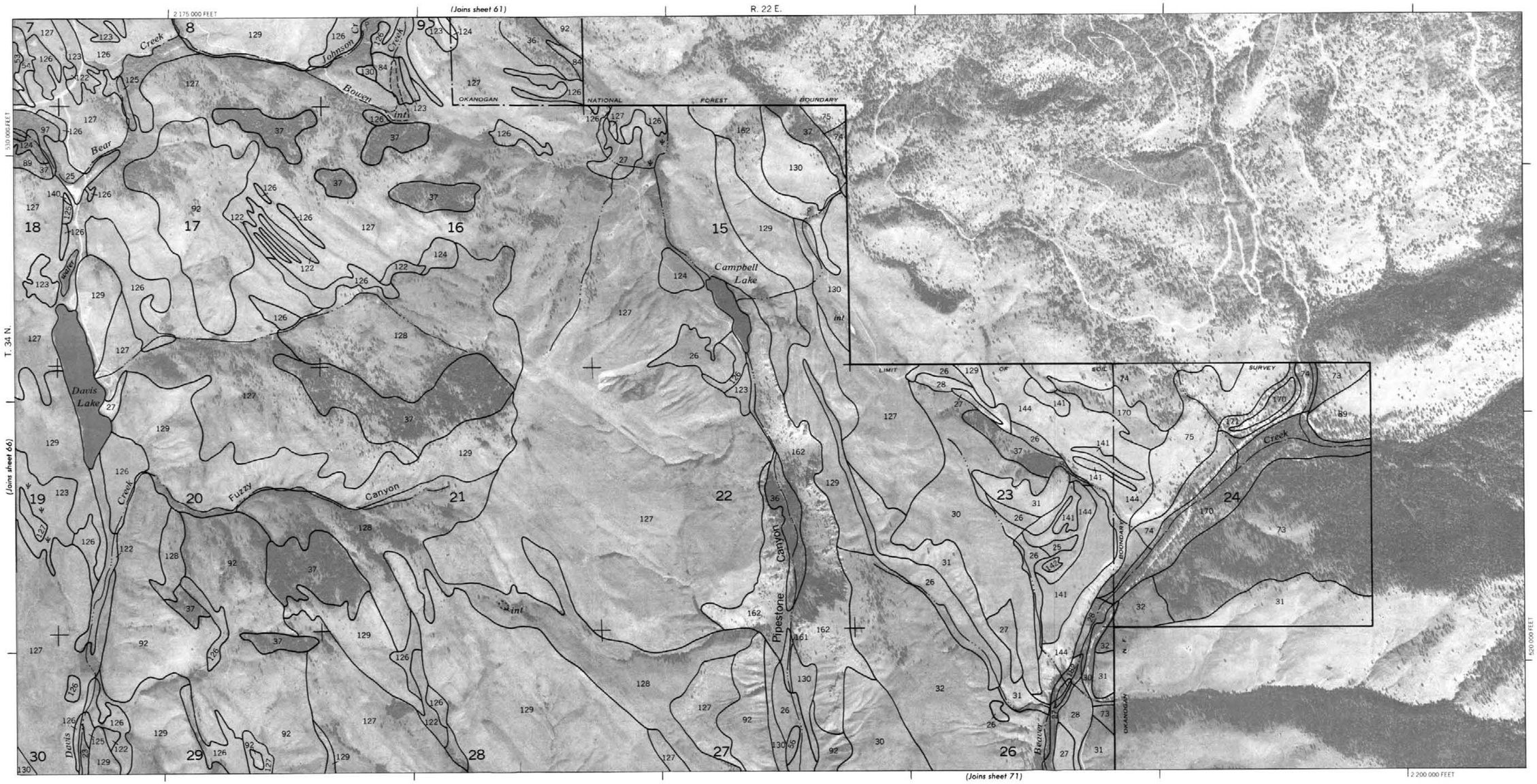
This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

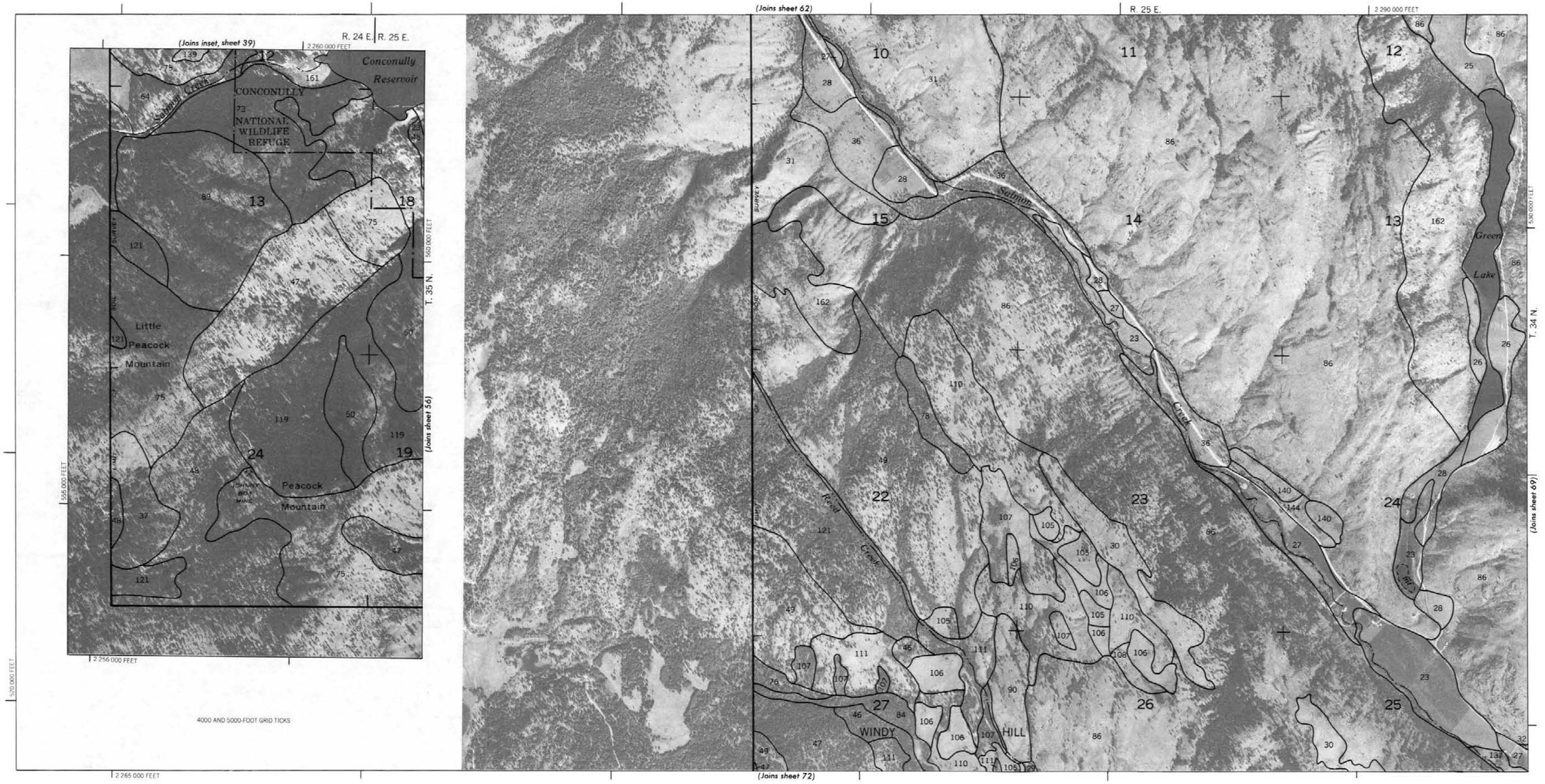


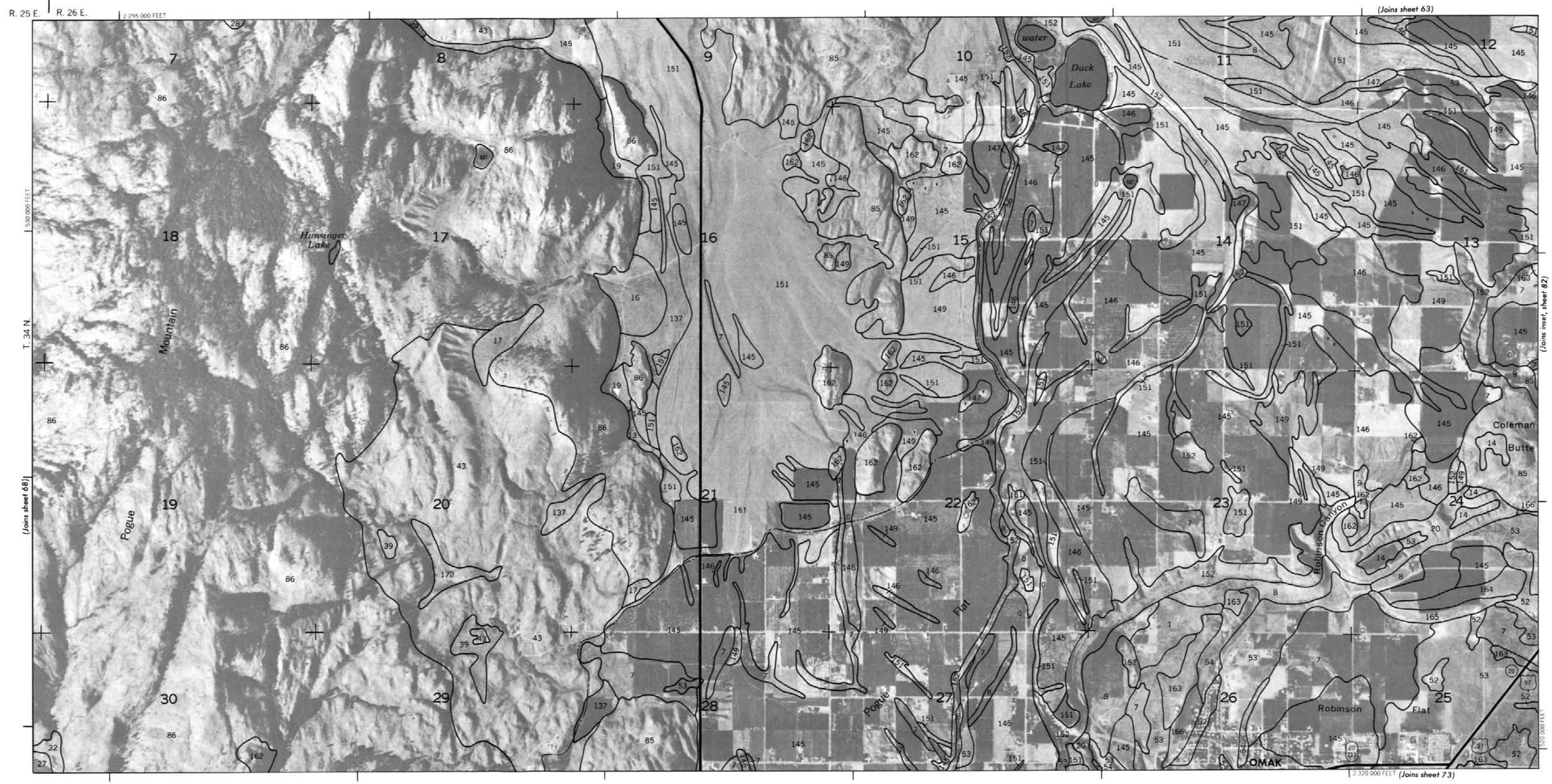


5,000 foot grid ticks based on state coordinate system Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

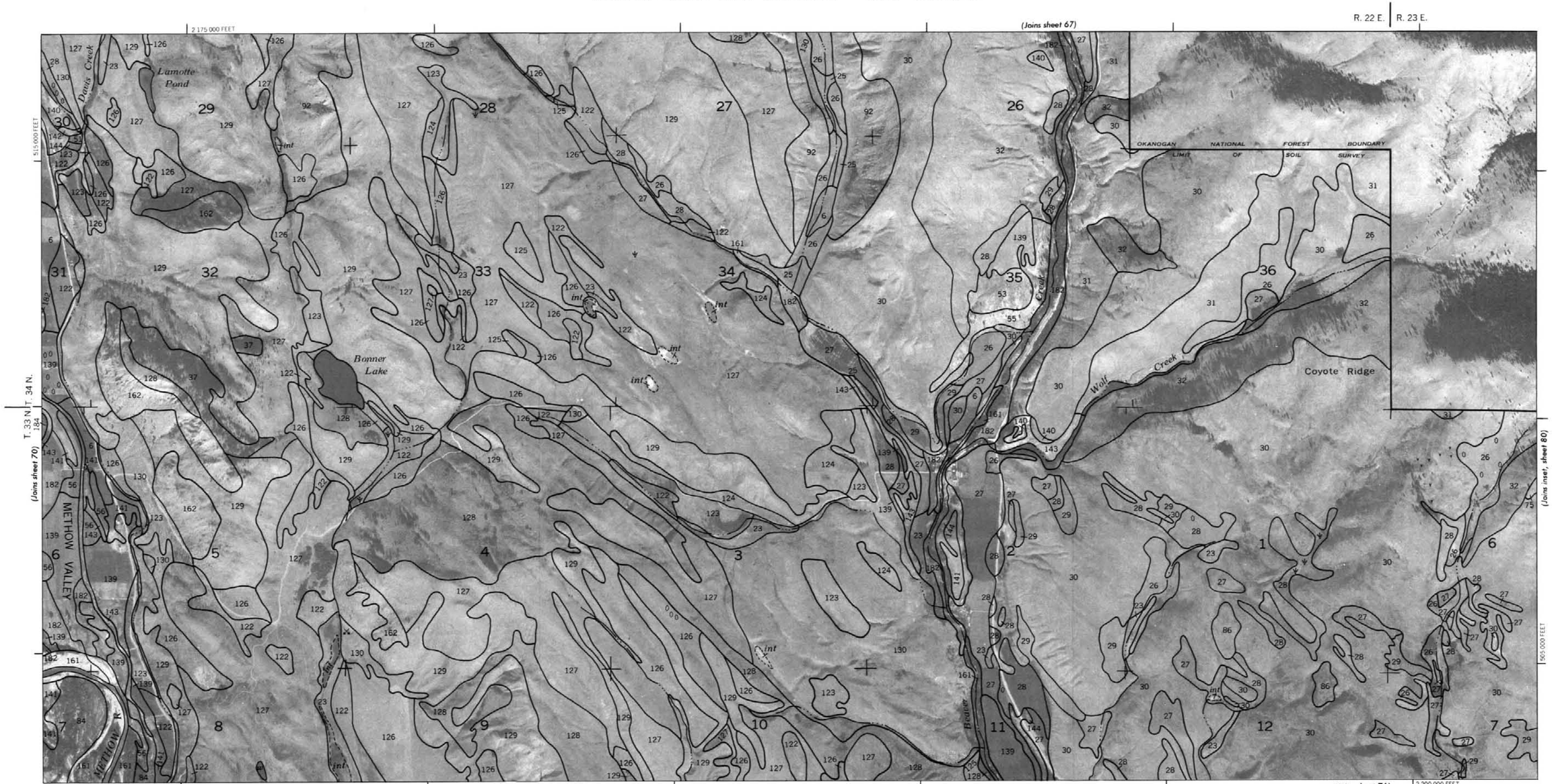


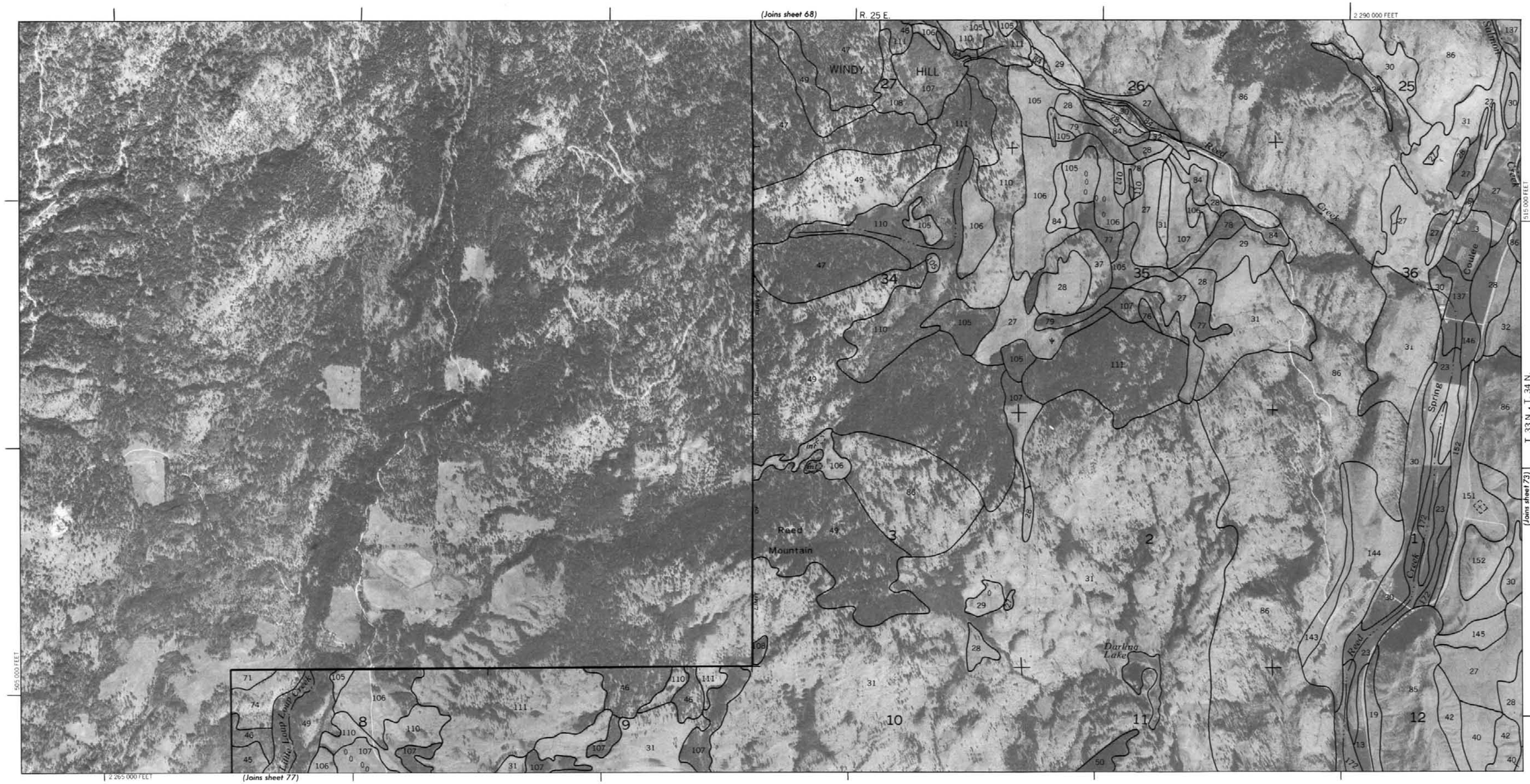




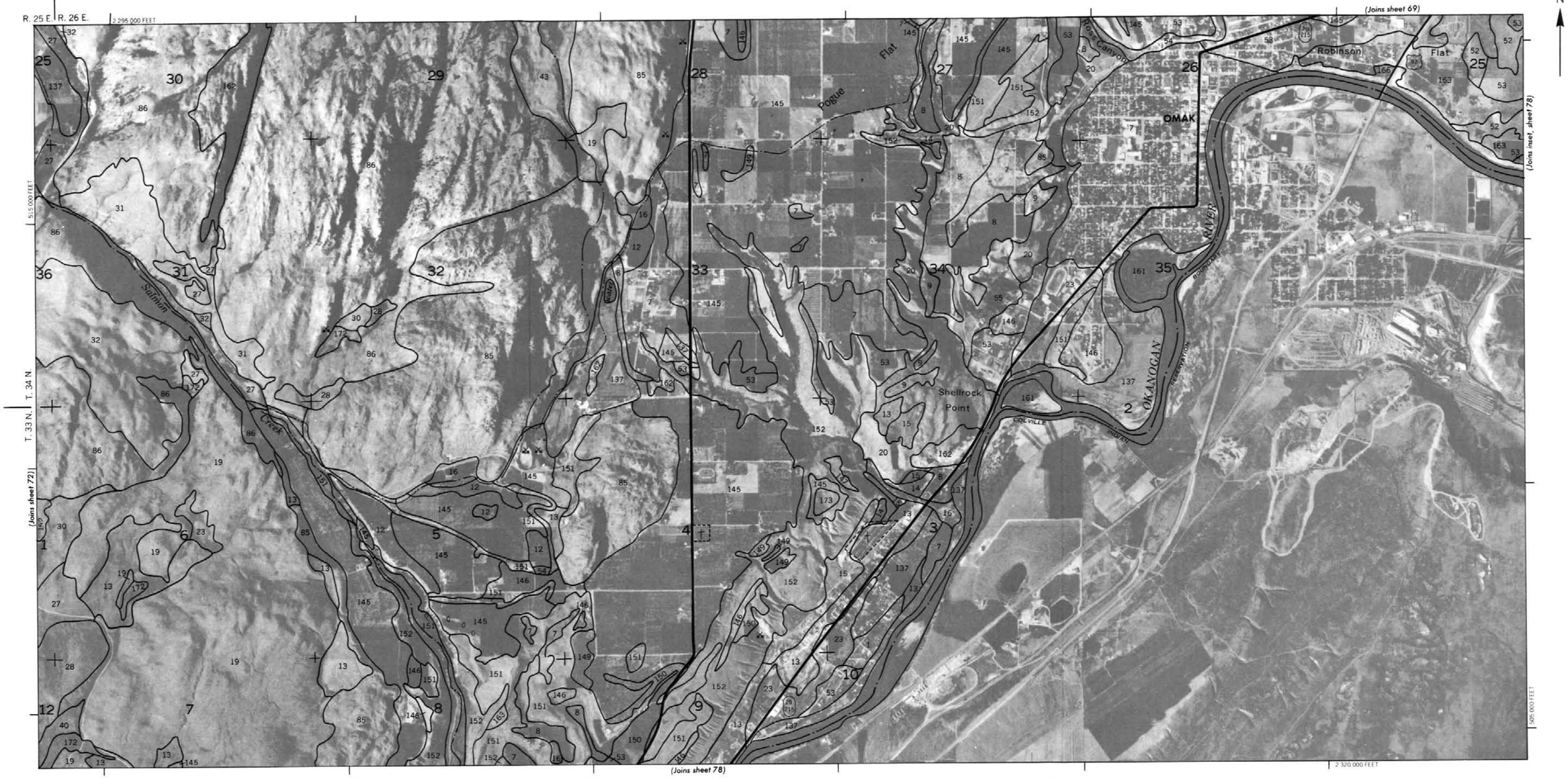
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U.S. Department of the Interior, Geological Survey or Photobathygraphy by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies



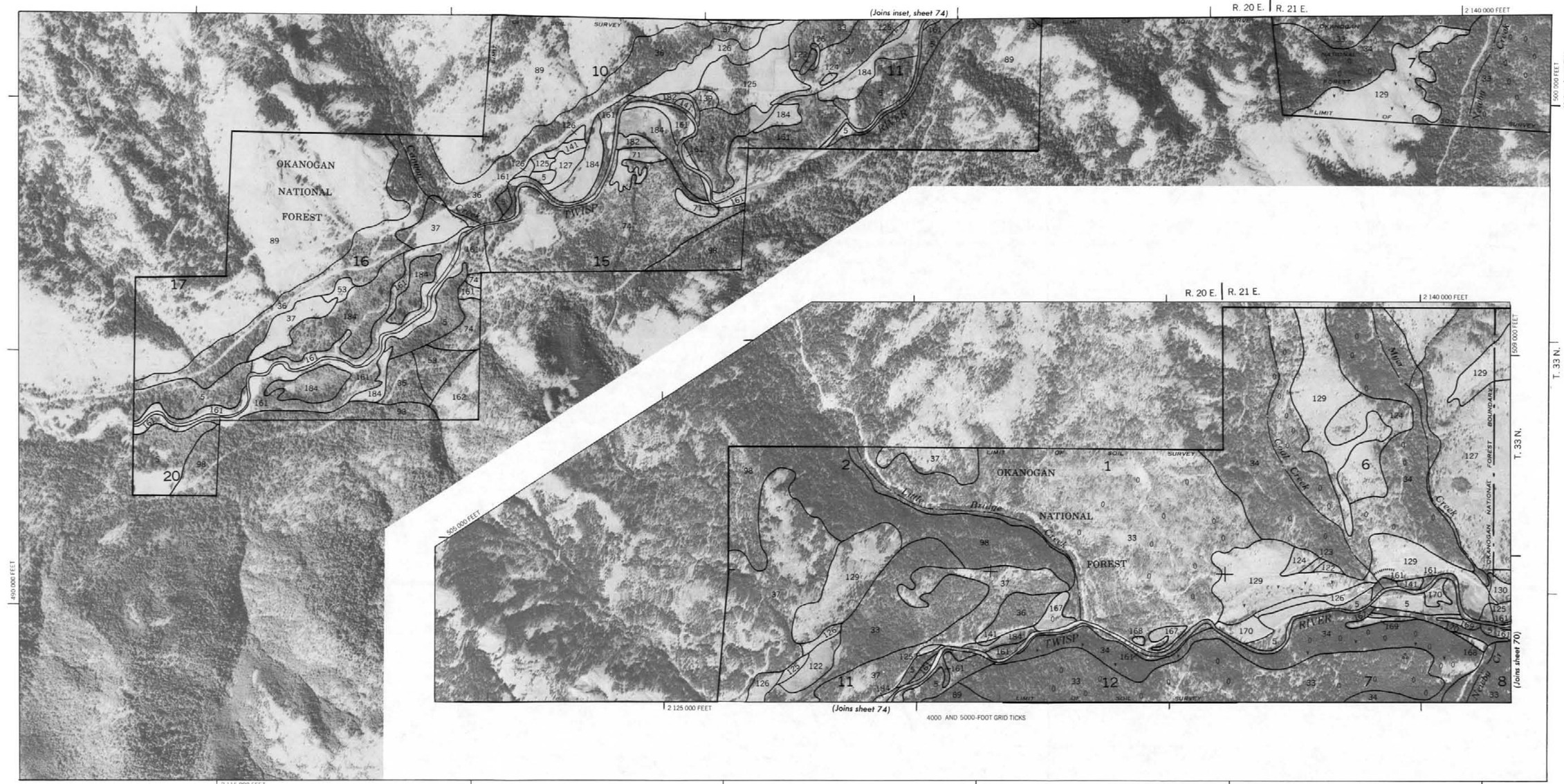


This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned



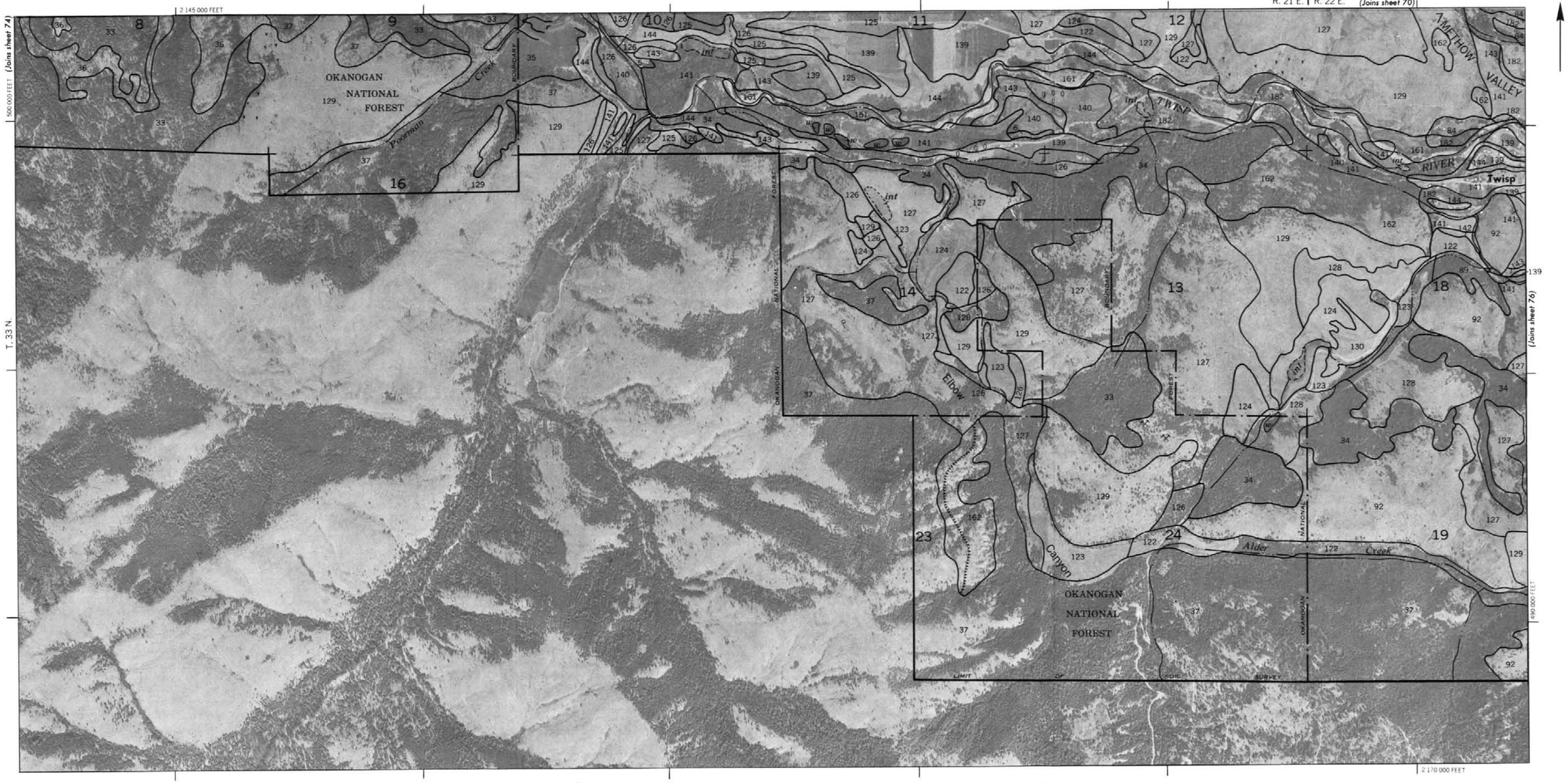
This map was compiled on 1979 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

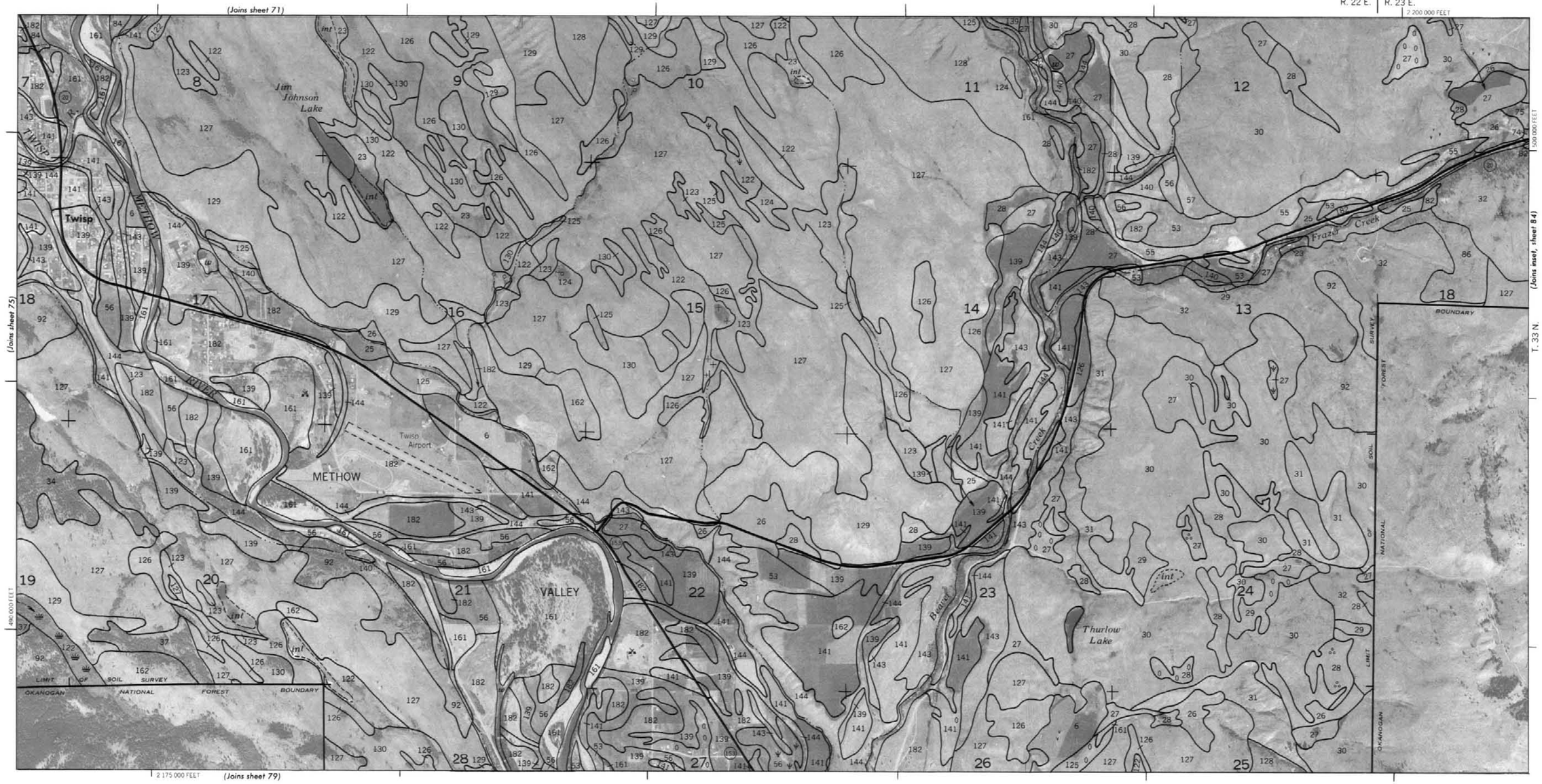
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 74



5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

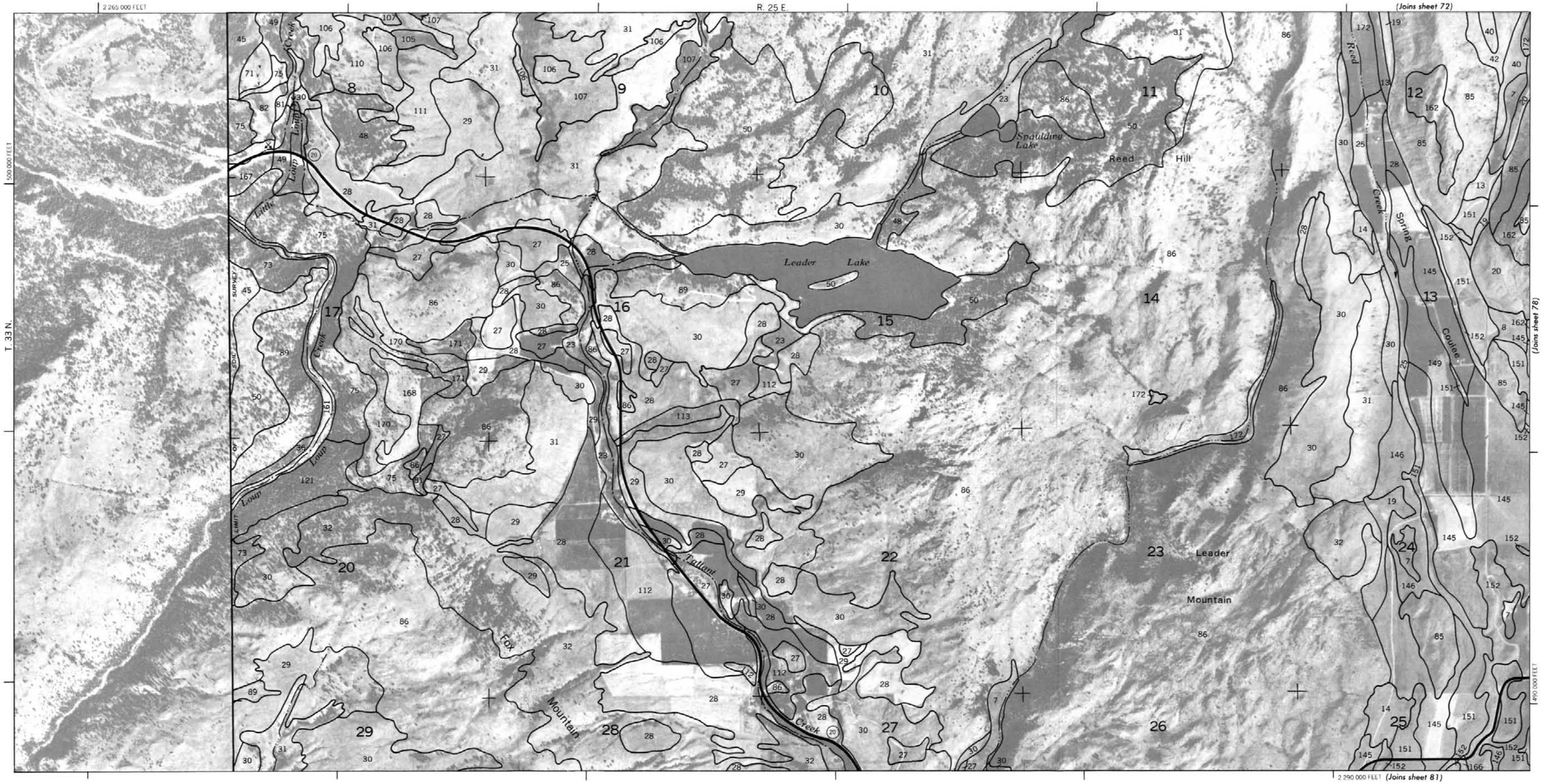
This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies

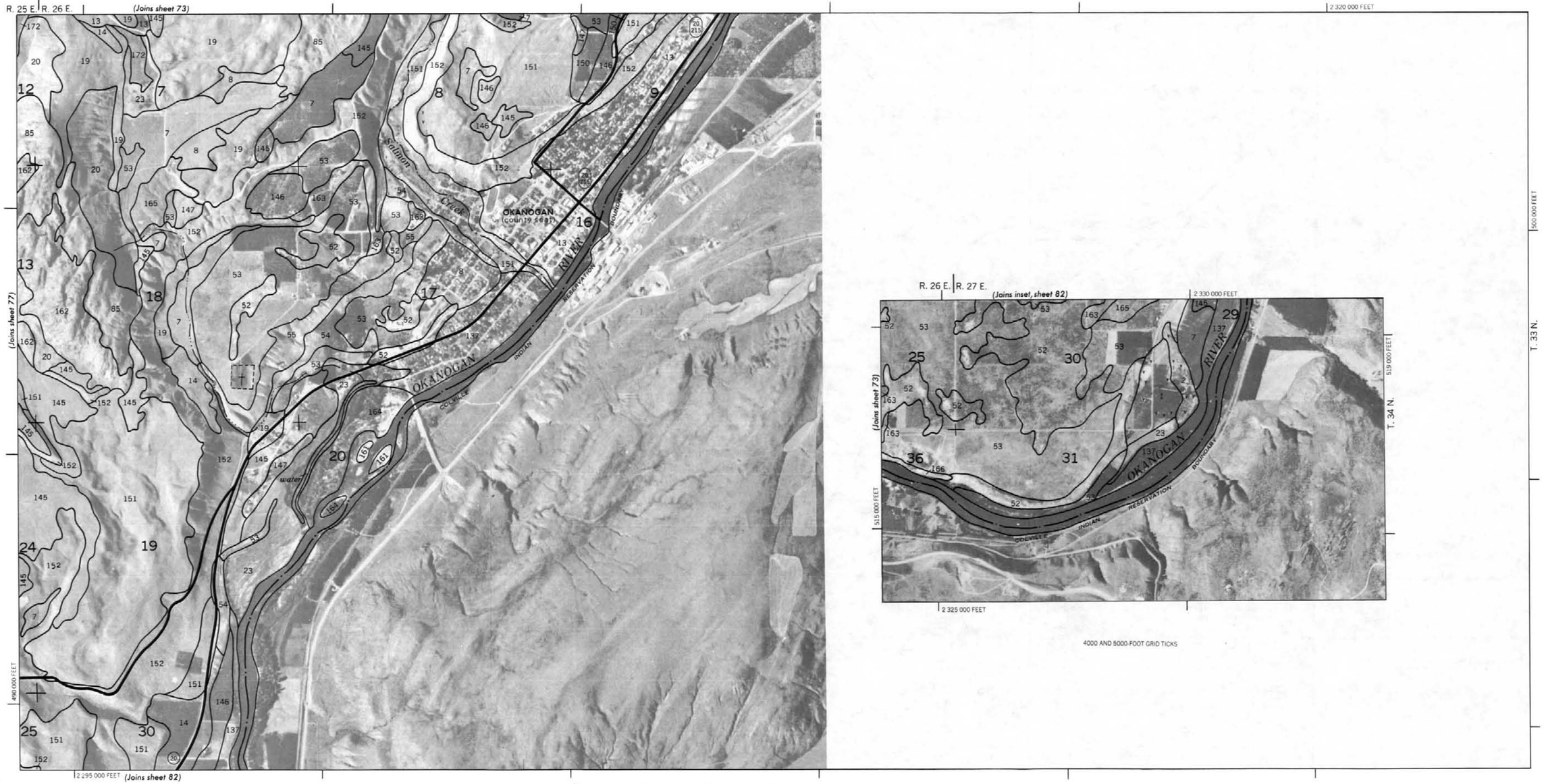




5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies





4000 AND 5000-FOOT GRID TICKS

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20000

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

R. 23 E.

2 210 000 FEET

R. 24 E.

R. 25 E.

2 260 000 FEET

510 000 FEET

505 000 FEET

485 000 FEET

475 000 FEET

T. 33 N.

T. 32 N.

OKANOGAN NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

(Joins sheet 71)

(Joins inset, sheet 84)

(Joins sheet 84)

(Joins sheet 81)

2 205 000 FEET

2 235 000 FEET

Chiliwist

Butte

Lake

Smith

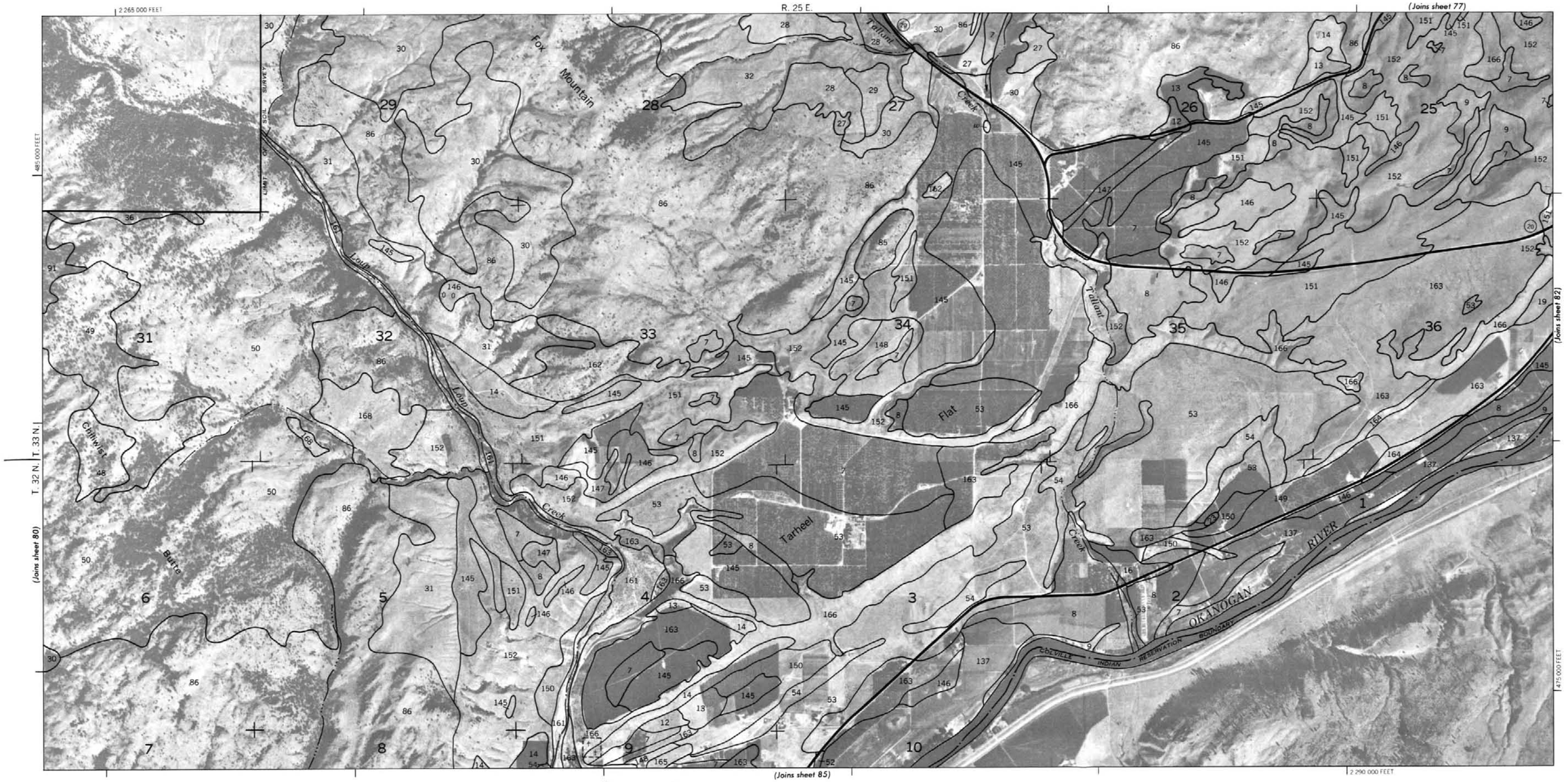
Valley

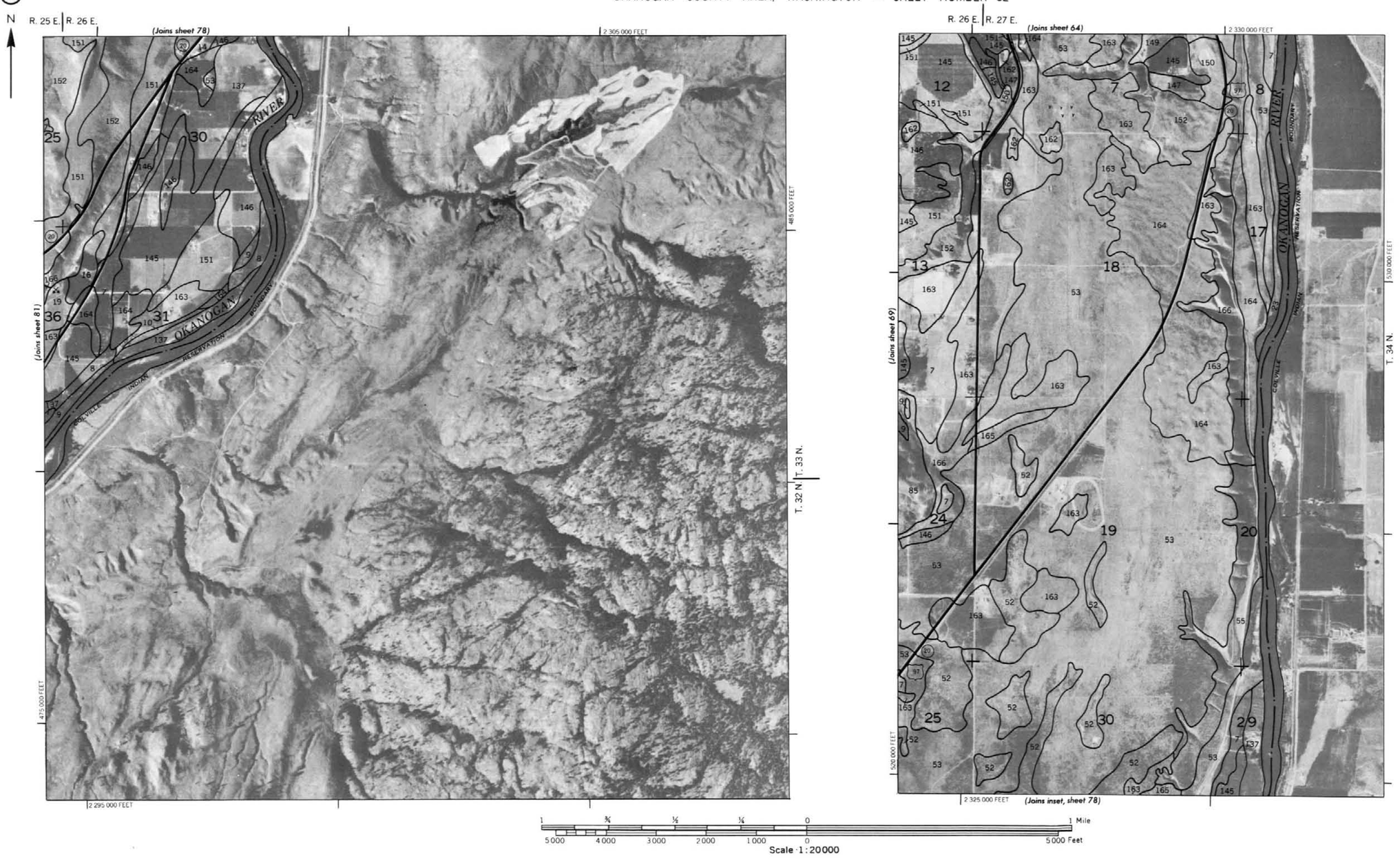
Interurban

1 Mile

5000 Feet

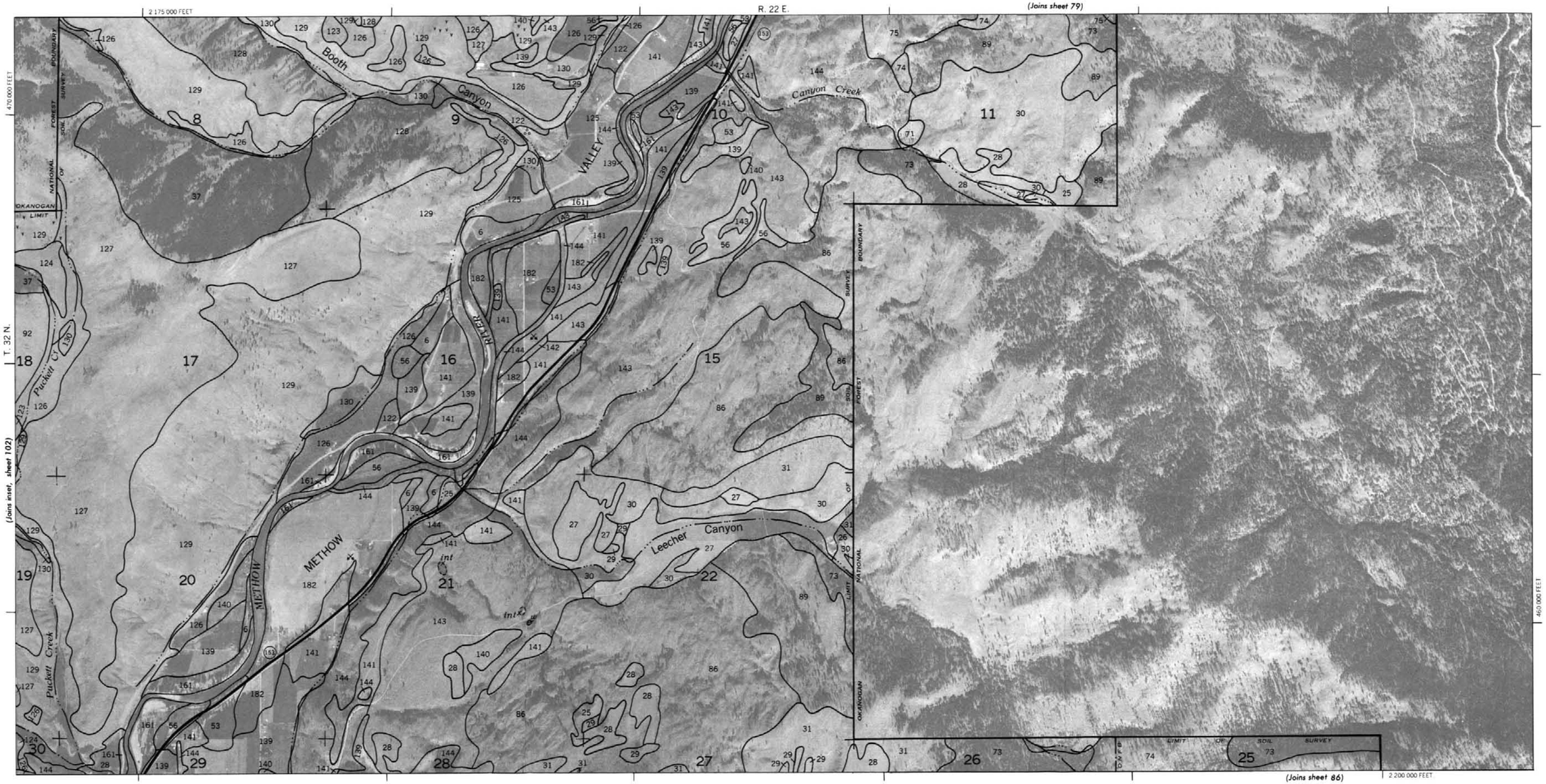
Scale 1:20000



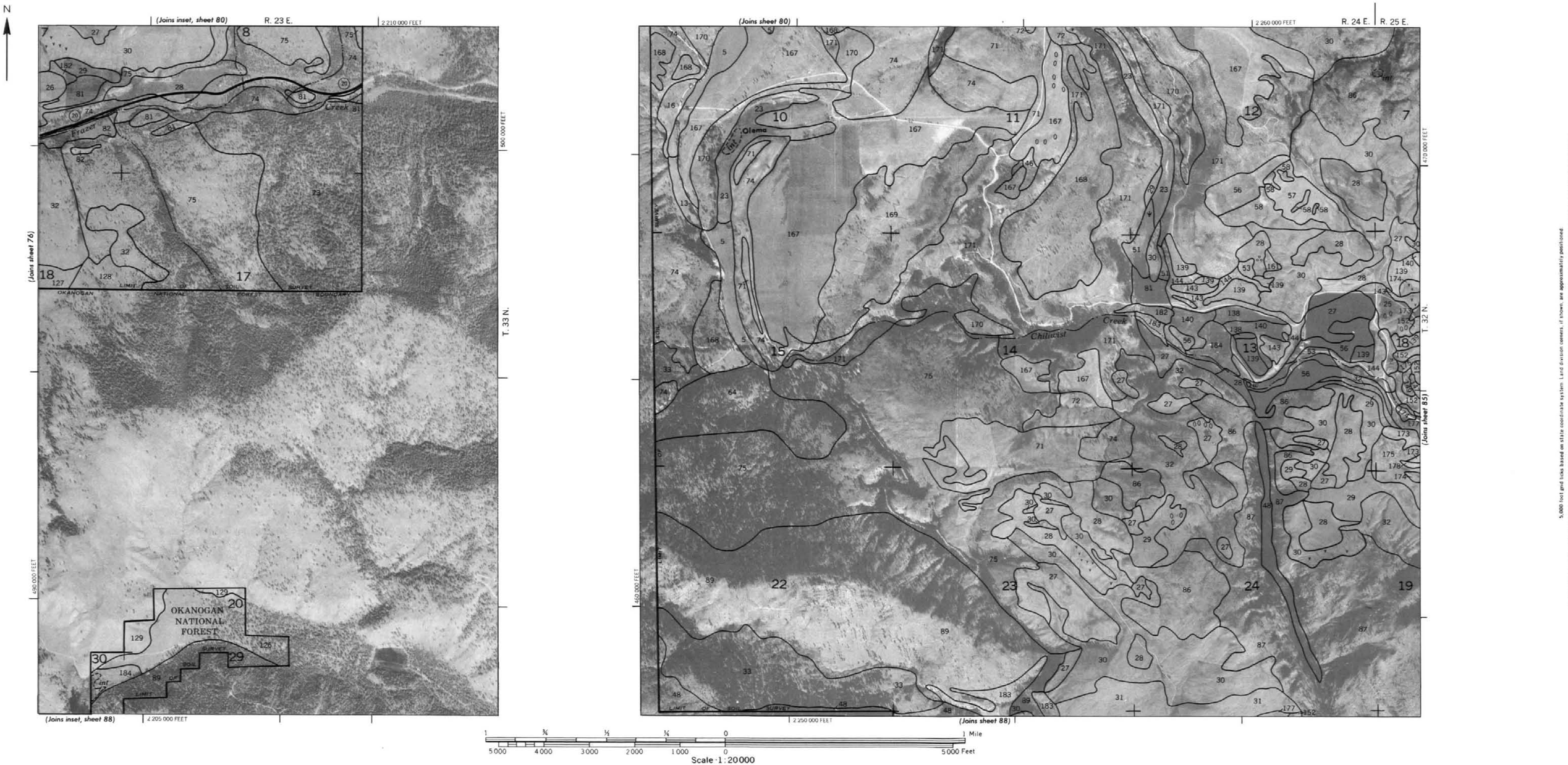


This map was compiled on 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

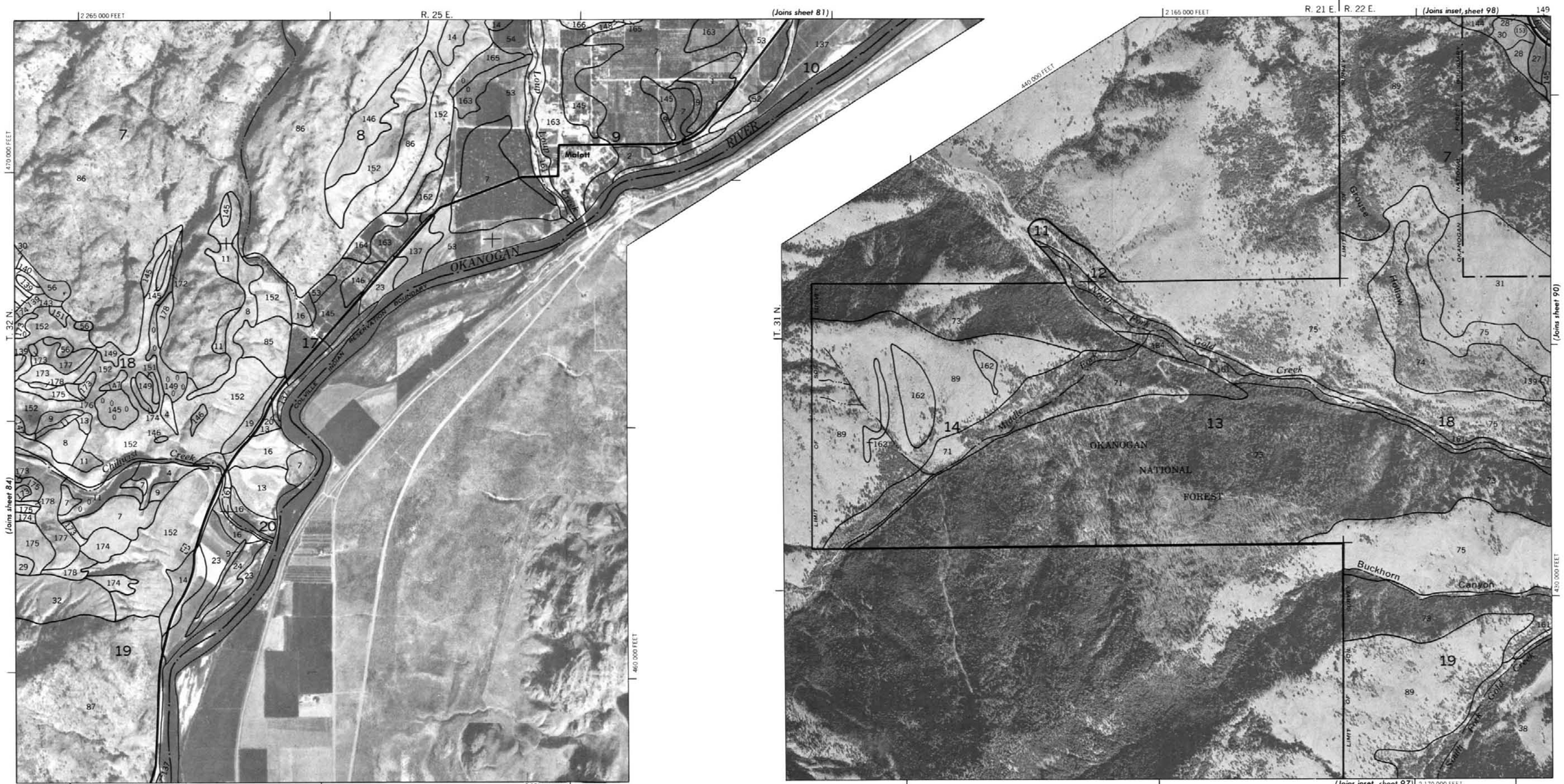
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

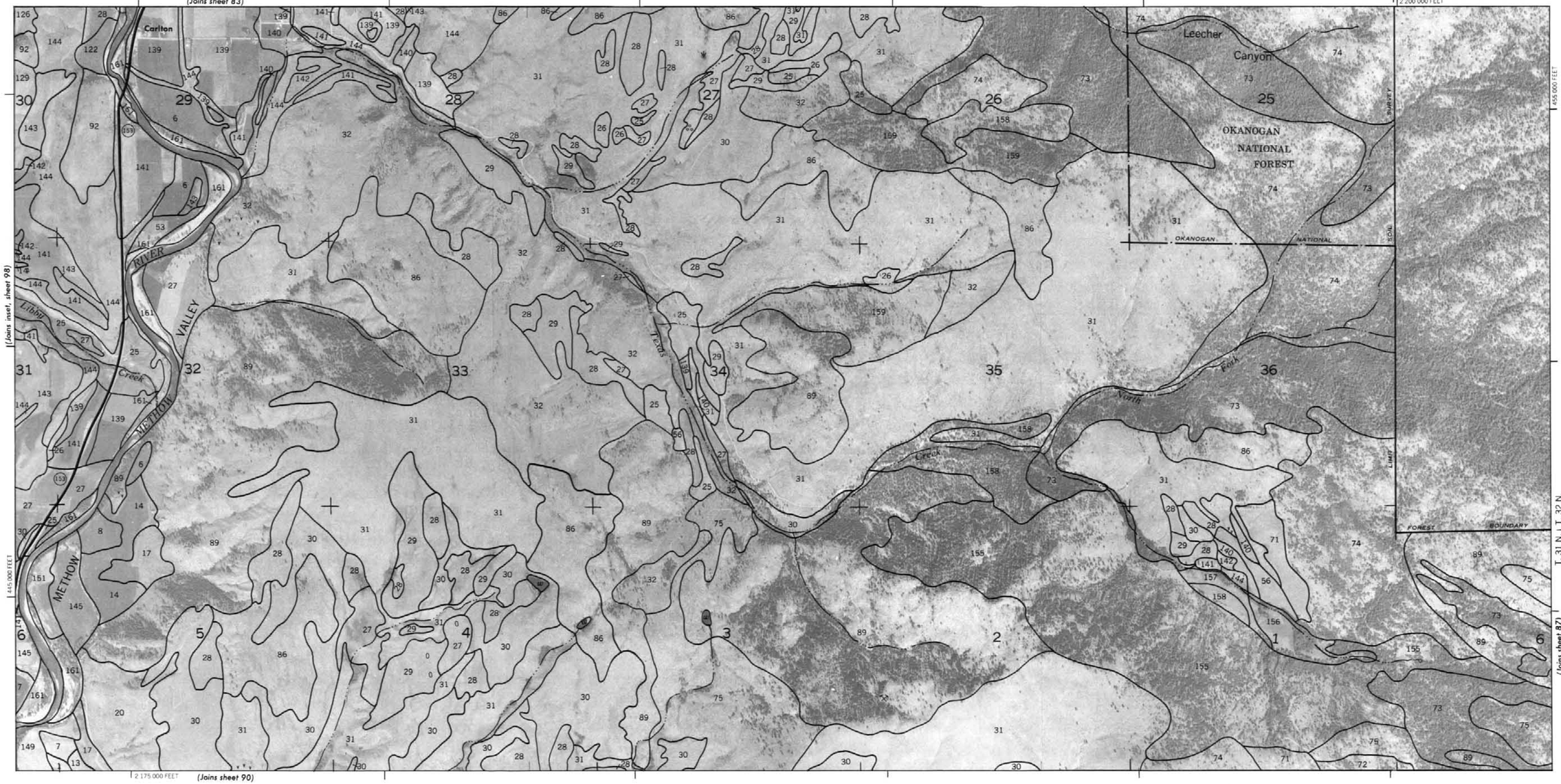


OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 84



5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.
This map was compiled on 1971 US Department of The Interior, Geological Survey orthophotography by the US Department of Agriculture, Soil Conservation Service and cooperating agencies

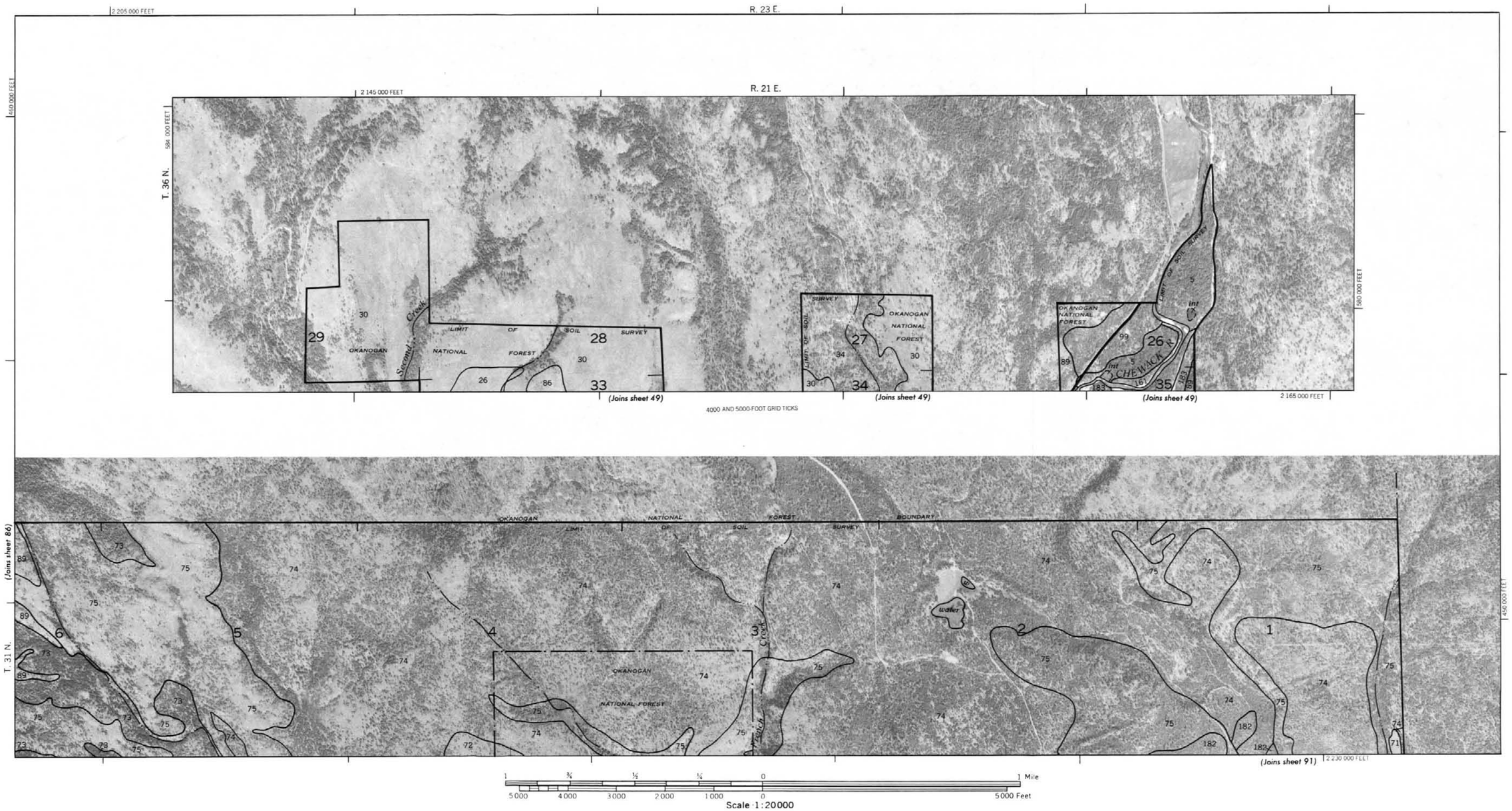


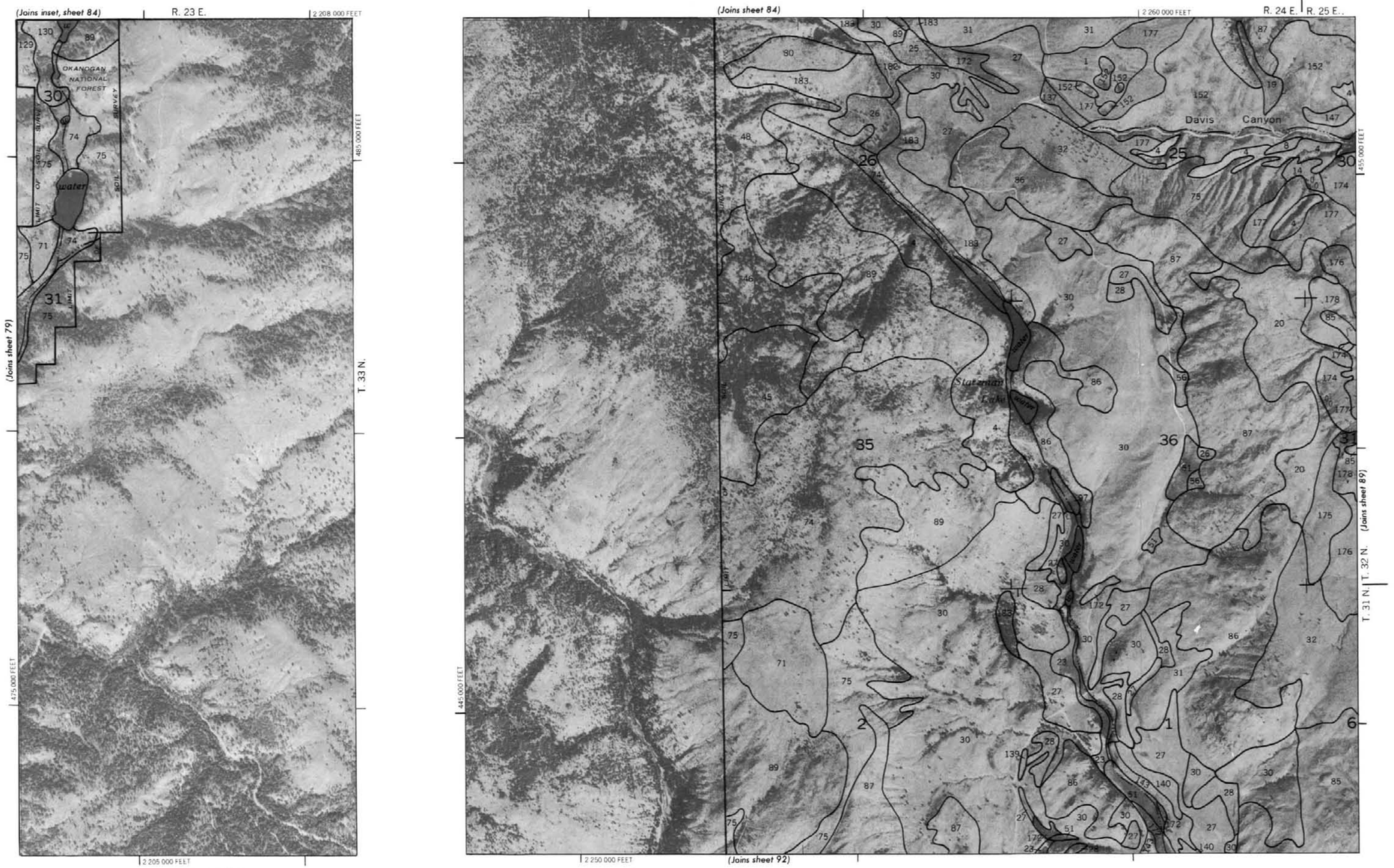


5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

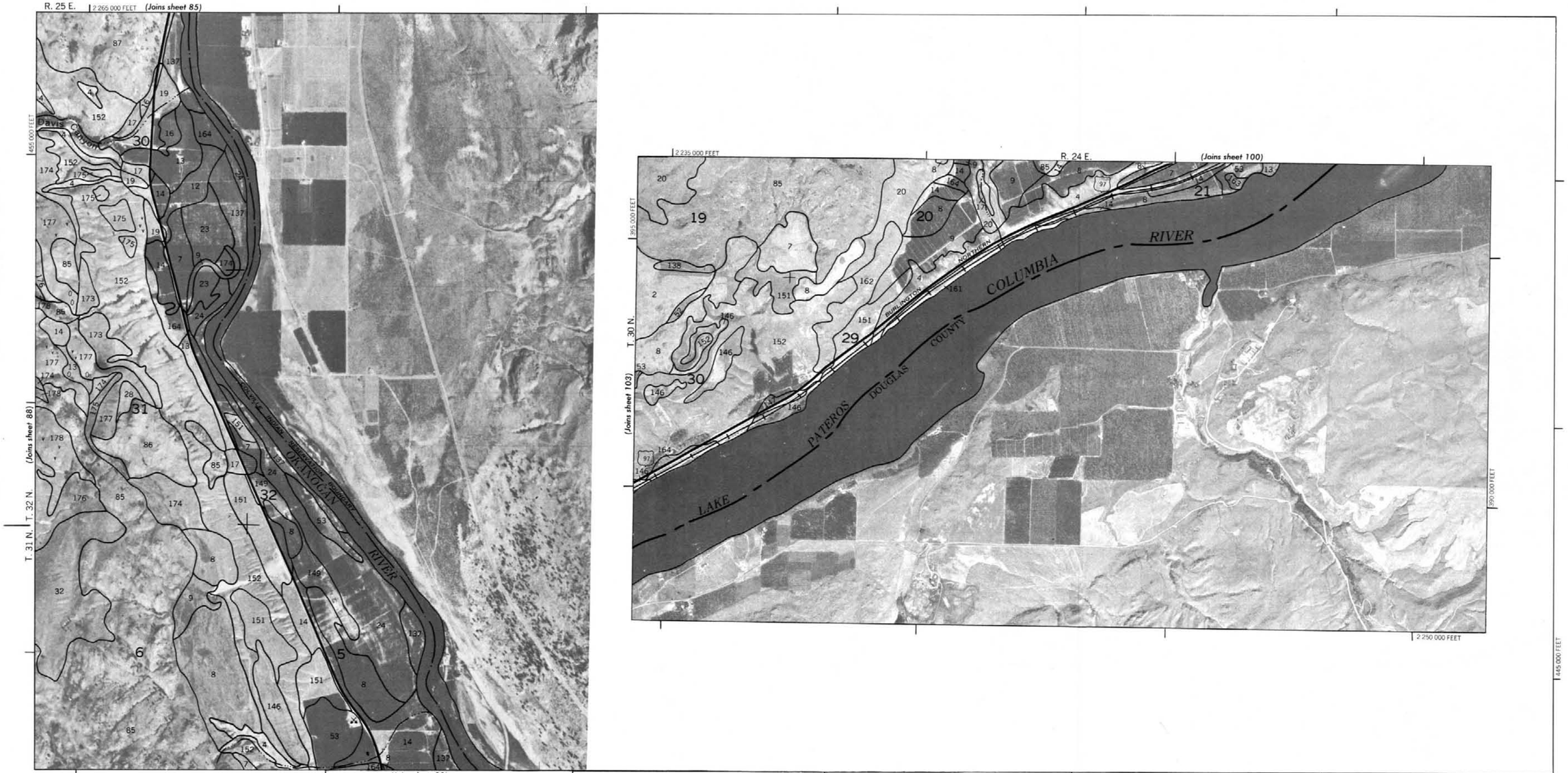
N





This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

N

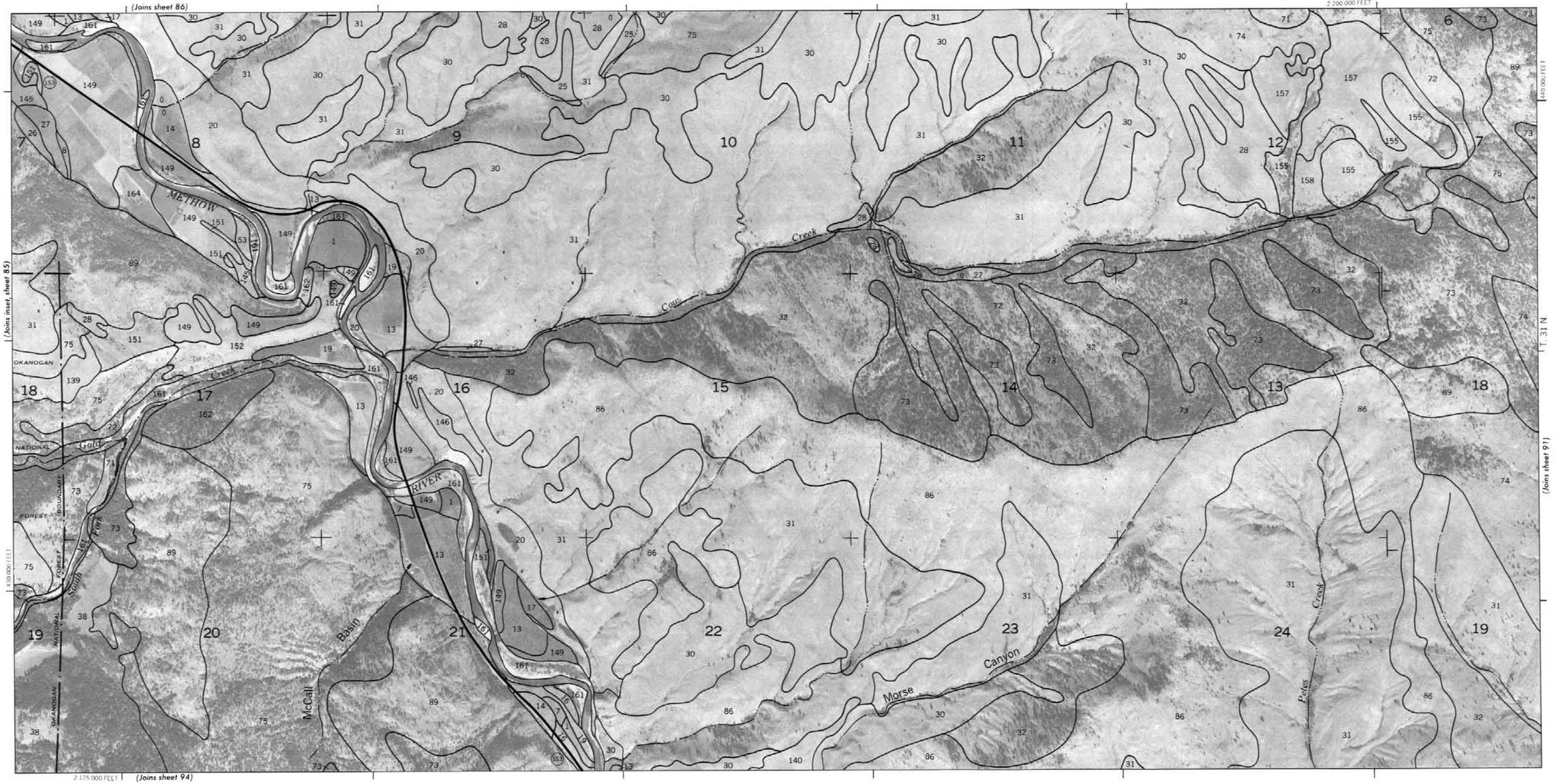


1 Mile

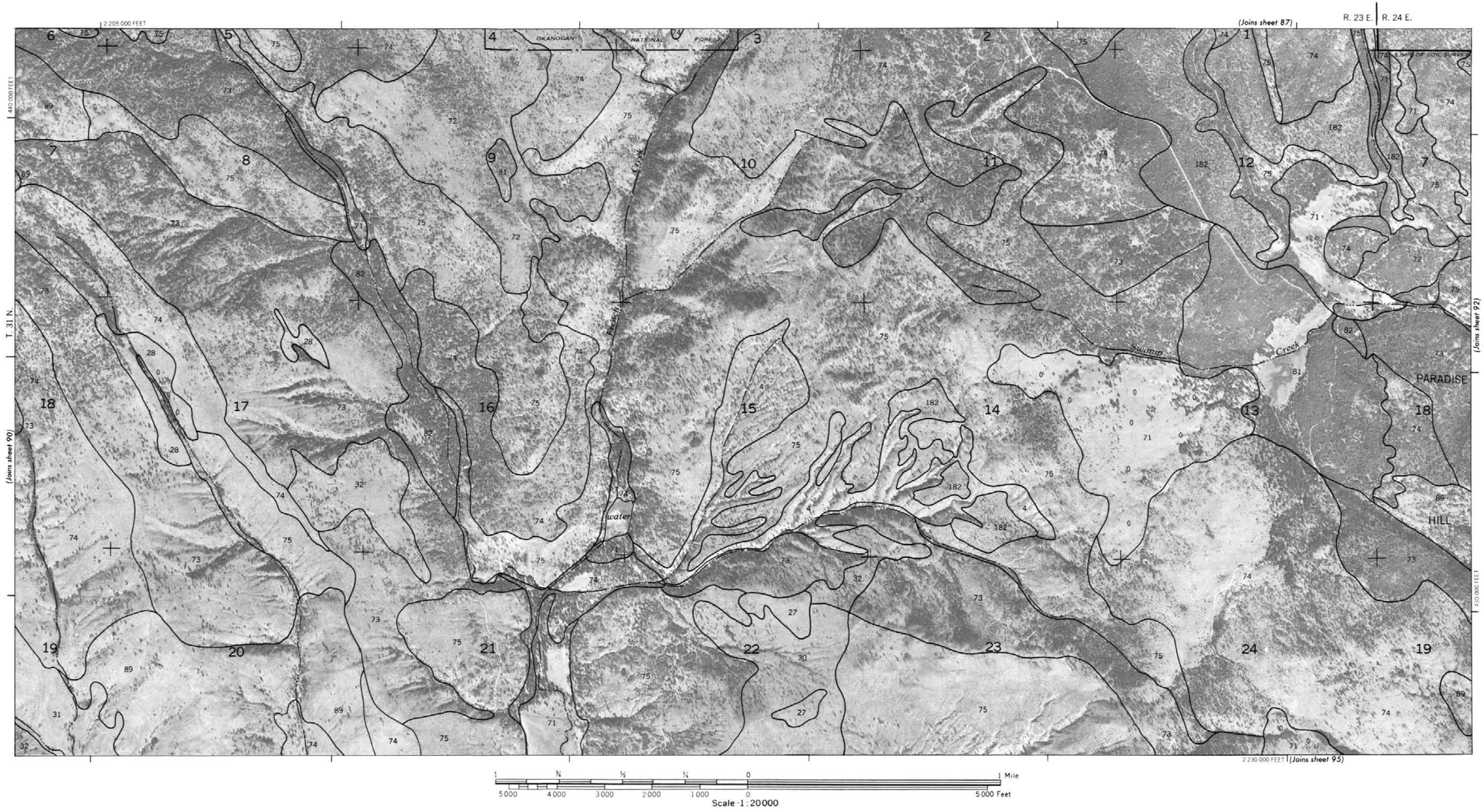
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

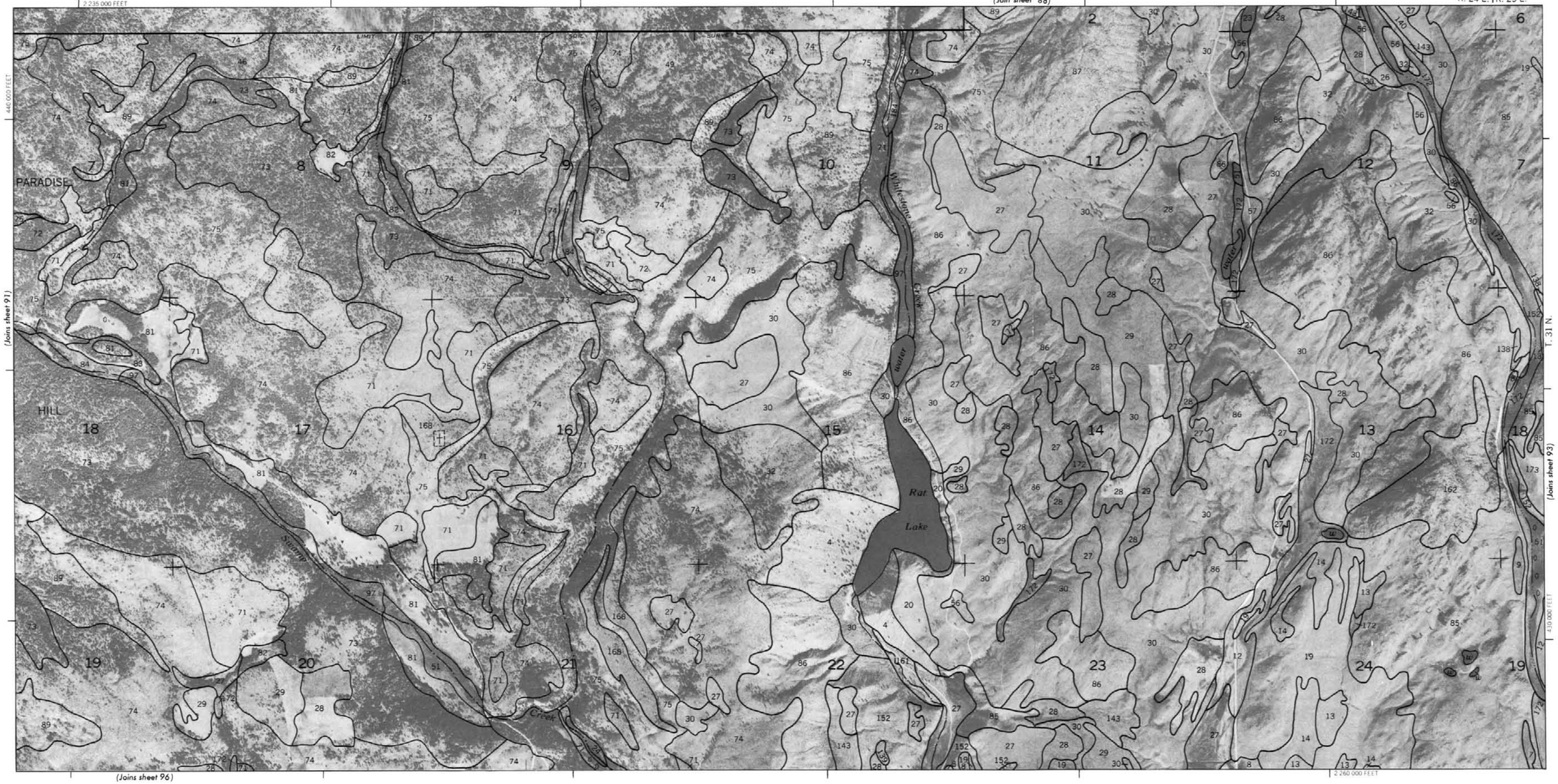
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 90



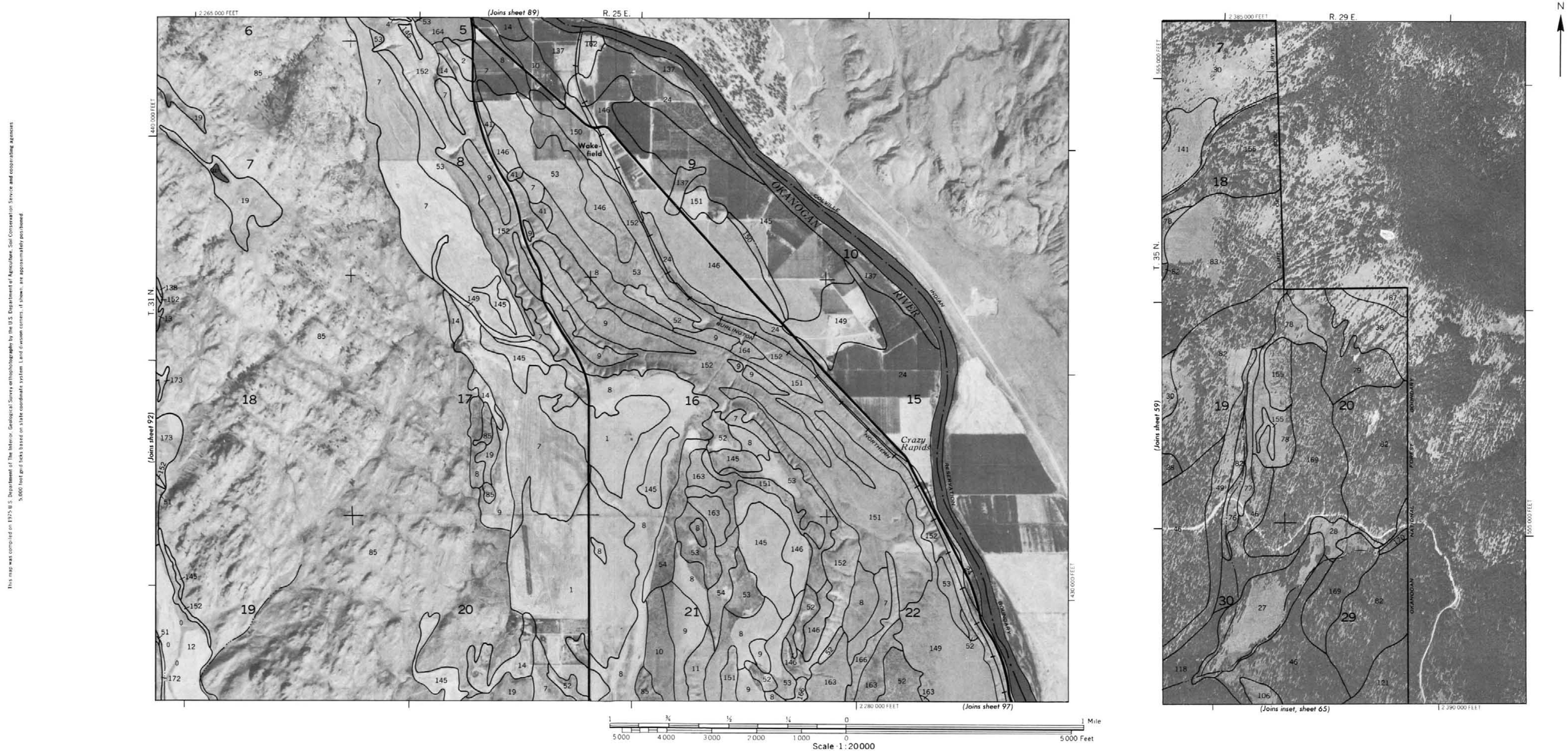
This map was compiled on 1975 U.S. Department of the Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned



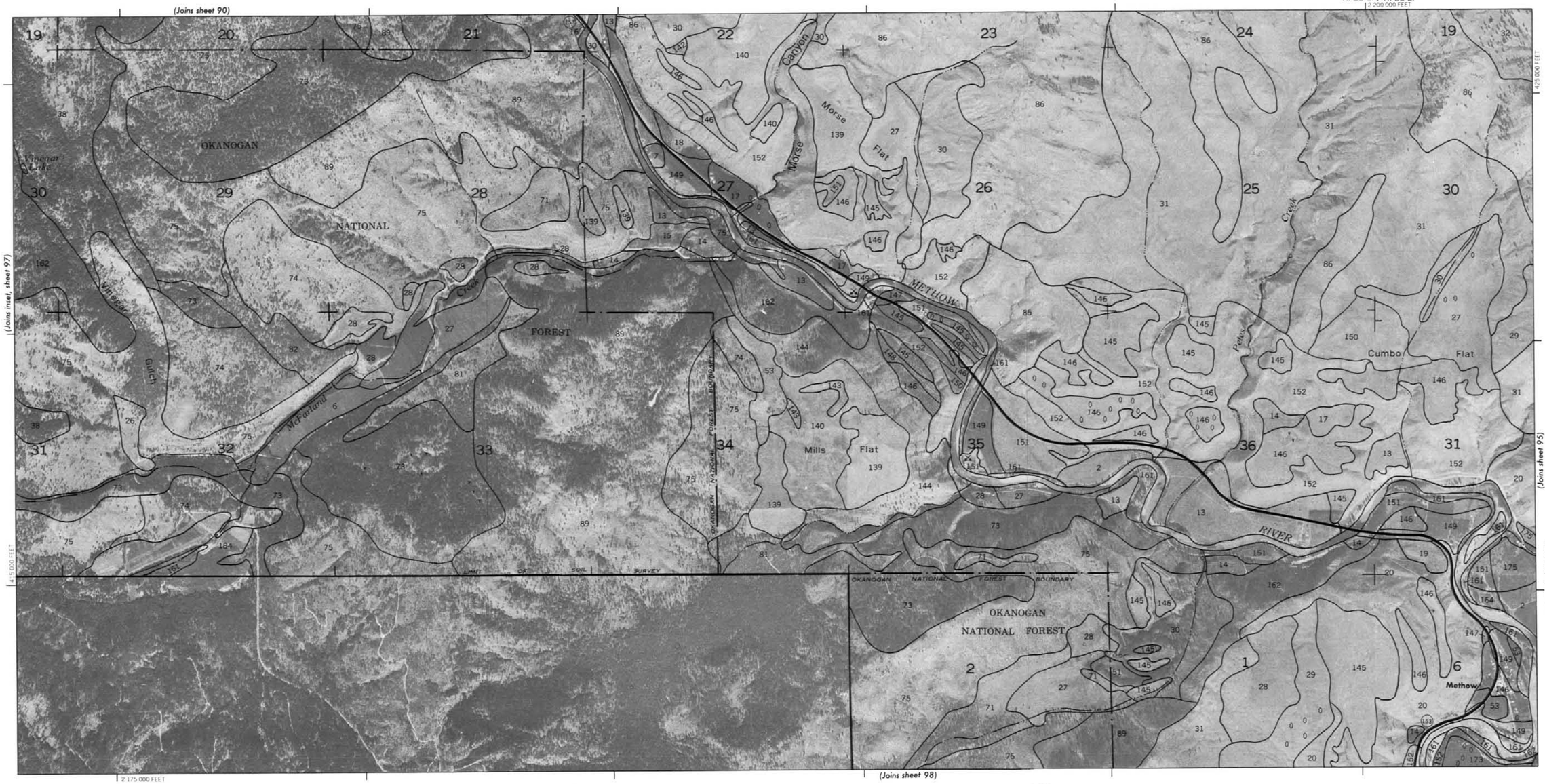
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 92



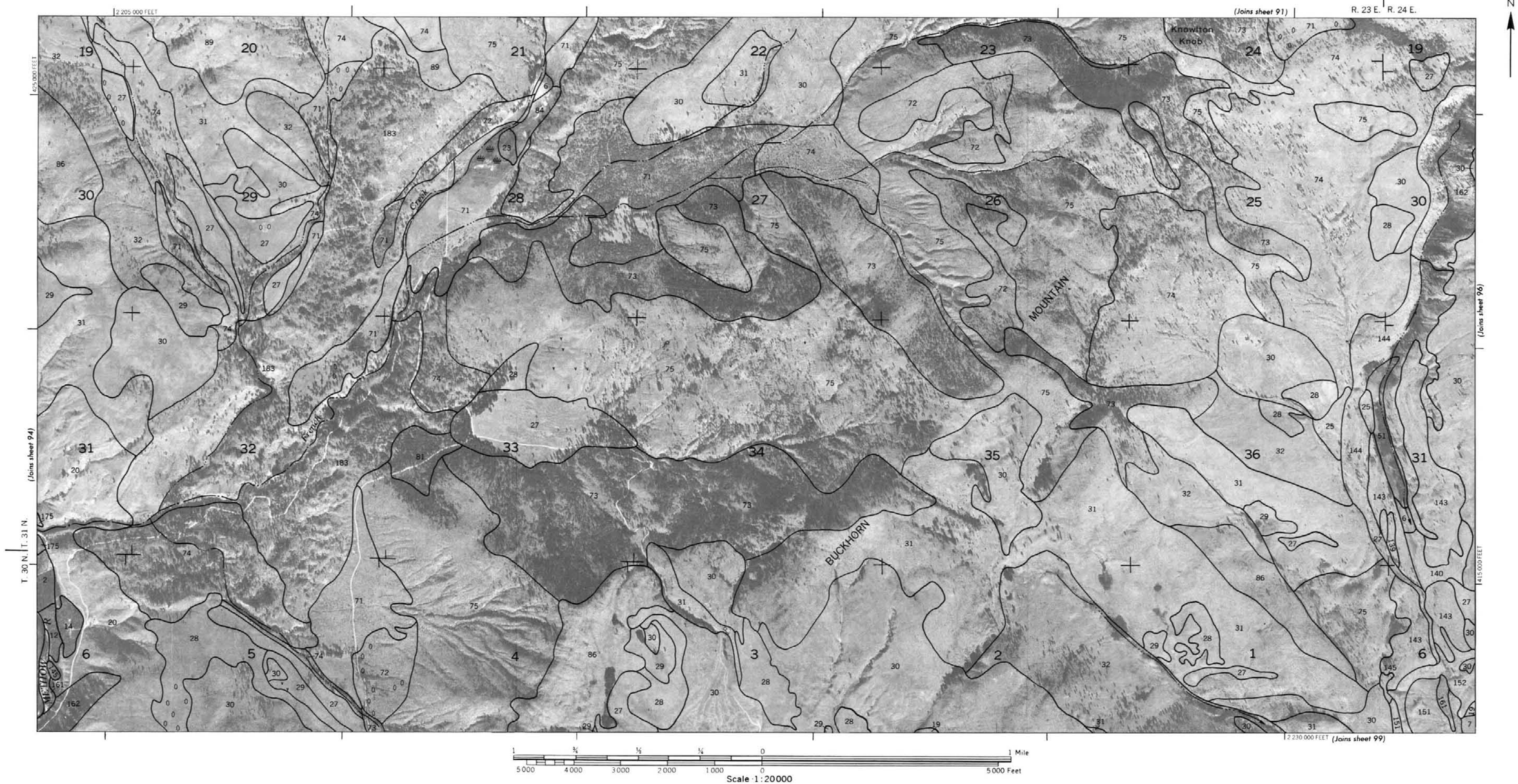
This map was compiled on 1935 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system Land division corners, if shown, are approximately positioned



OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 94



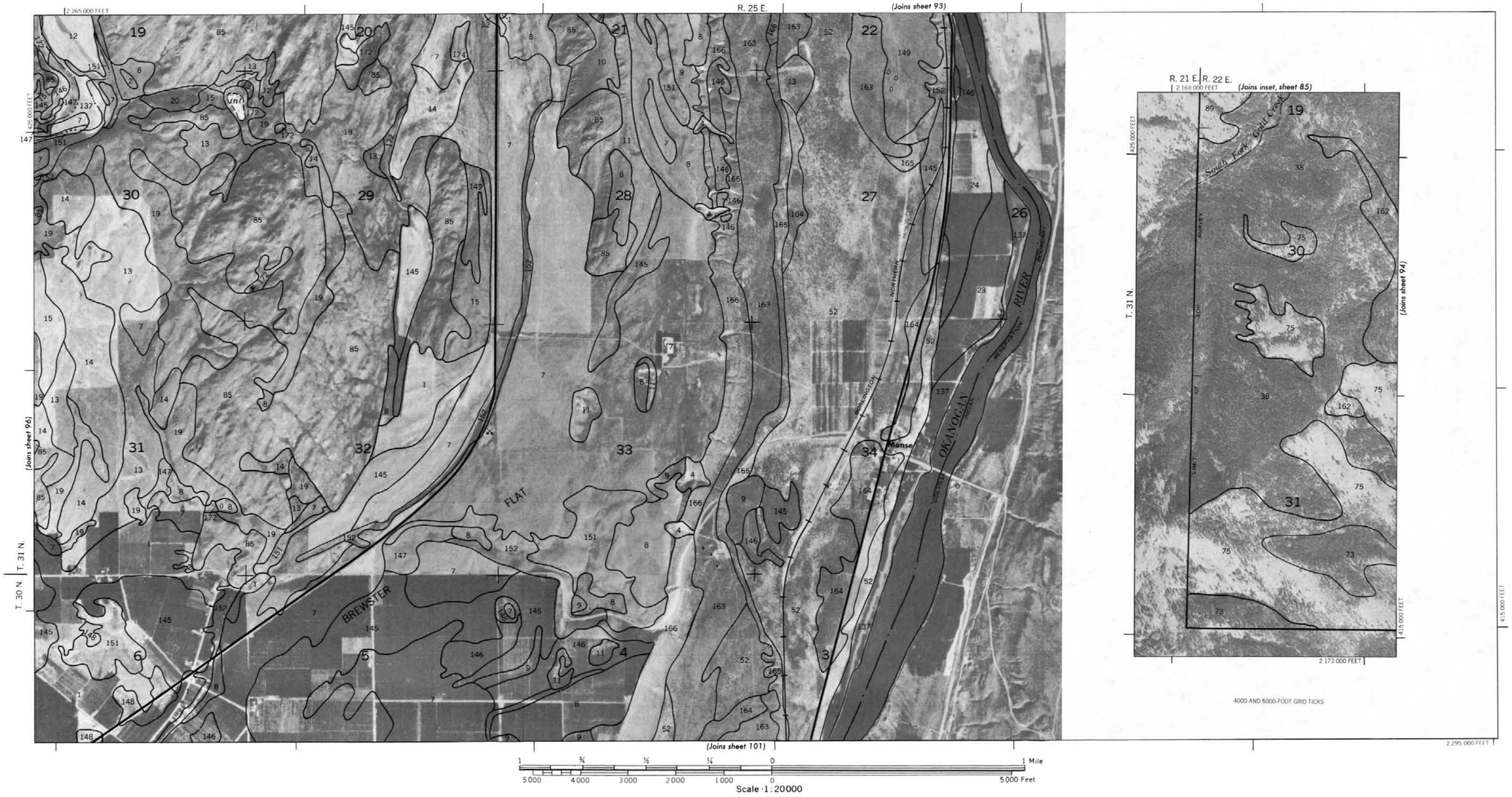
This map was compiled on 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned

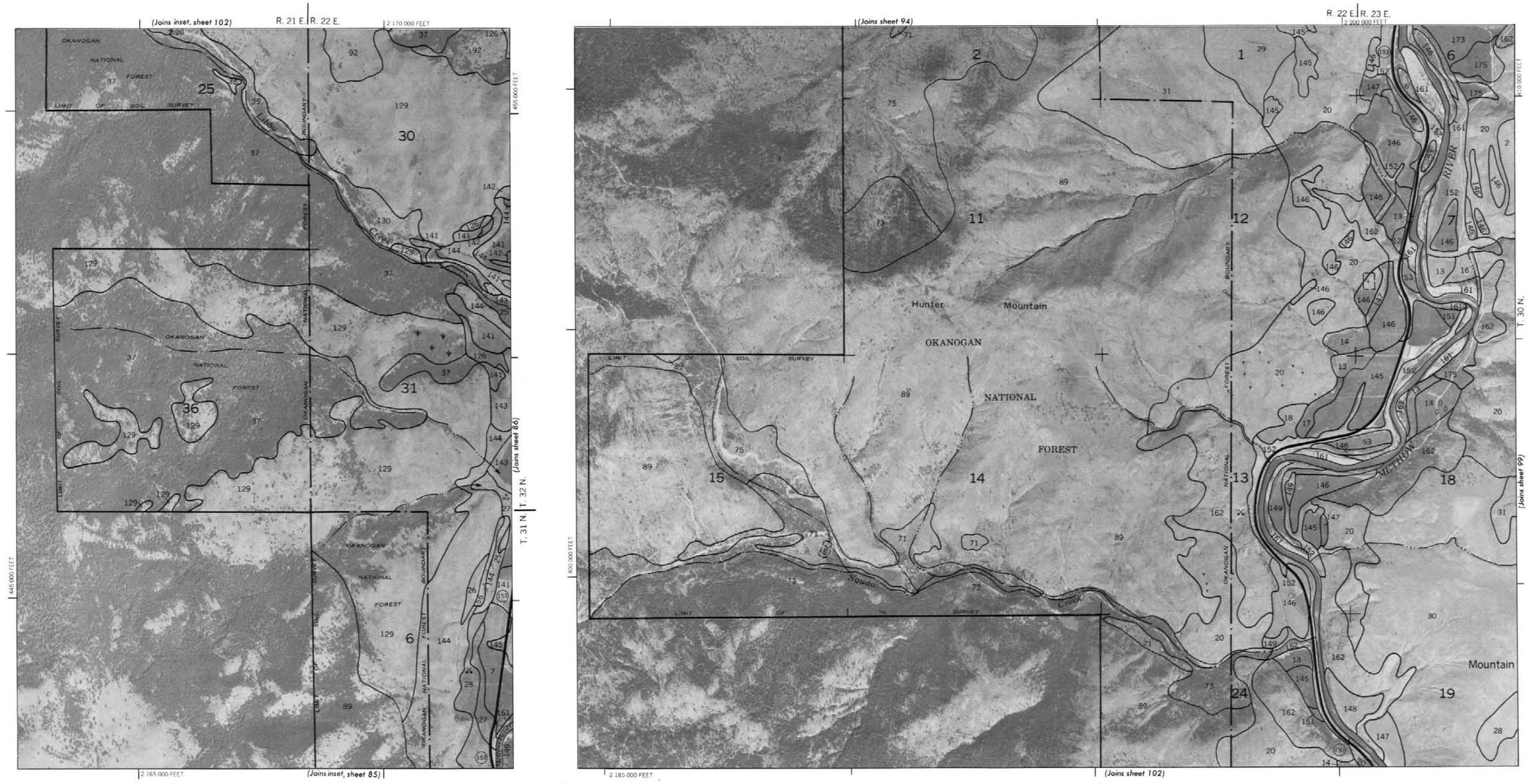


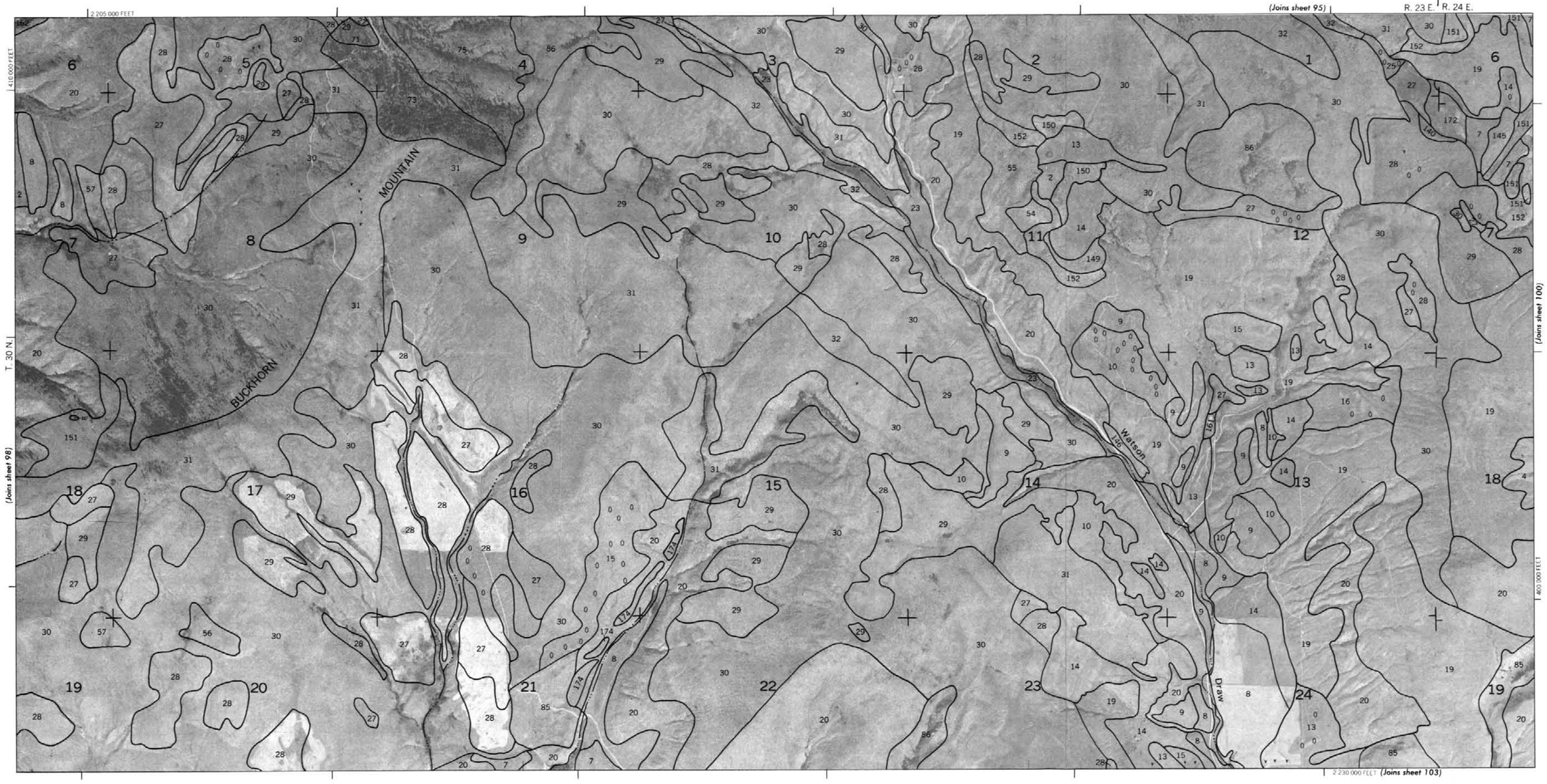
OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 96

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of the Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.







1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

OKANOGAN COUNTY AREA, WASHINGTON — SHEET NUMBER 100

5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 of U.S. Department of The Interior, Geological Survey photogrammetry by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
5,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

N

R. 21 E. R. 22 E. 2 170 000 FEET

R. 22 E. R. 23 E. 2 200 000 FEET

470 000 FEET

395 000 FEET

385 000 FEET

460 000 FEET

2 155 000 FEET

2 195 000 FEET

T. 32 N.

T. 30 N.

T. 29 N.

(Joins sheet 98)

(Joins sheet 83)

(Joins sheet 103)

(Joins inset, sheet 98)

OKANOGAN NATIONAL FOREST

FOREST BOUNDARY

BOUNDARY

LIMIT OF SOIL SURVEY

Libby Creek

Elderberry Canyon

Smith Canyon

Puckett Cr.

METHOW RIVER

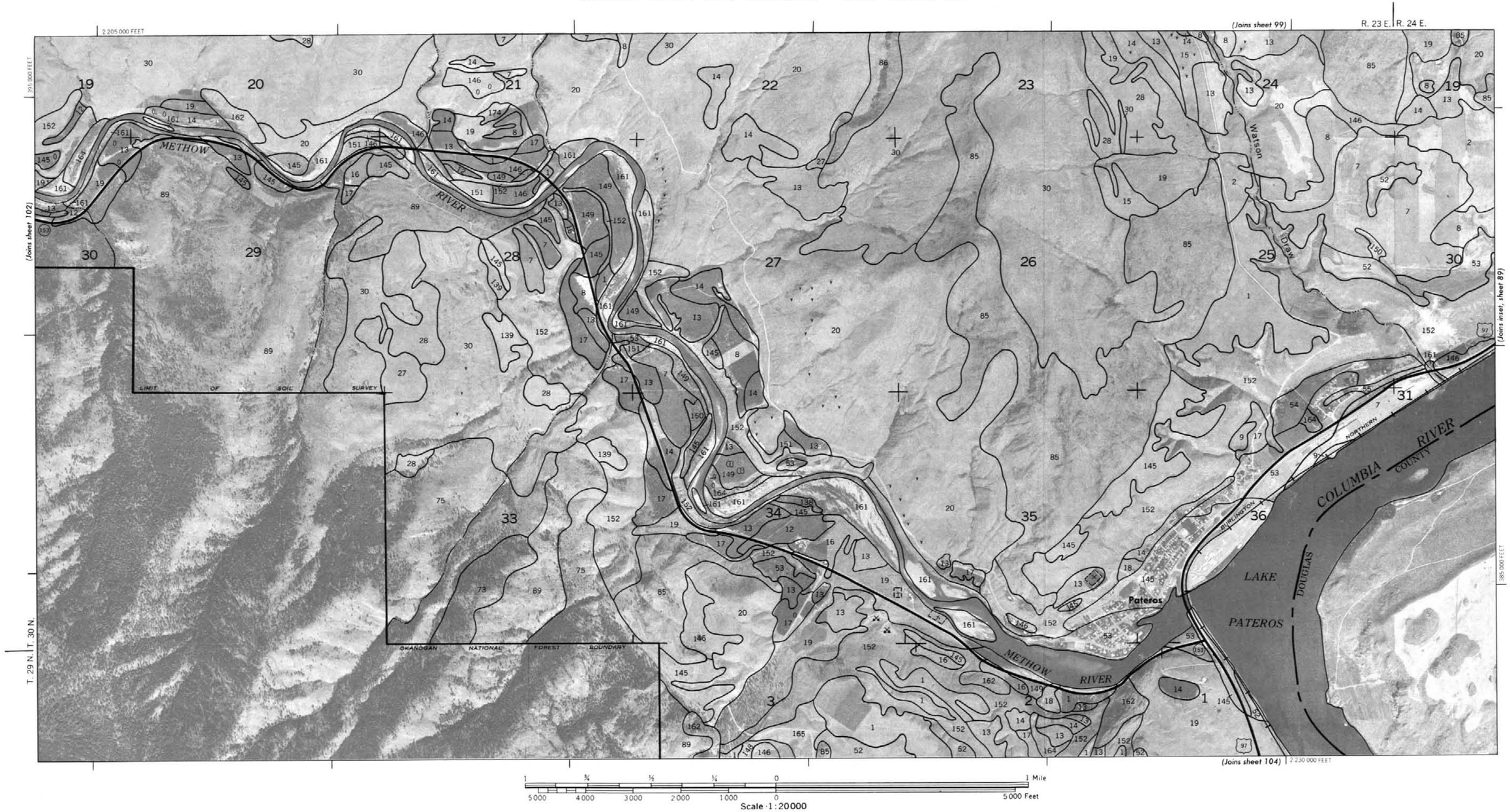
1 Mile

5 000 Feet

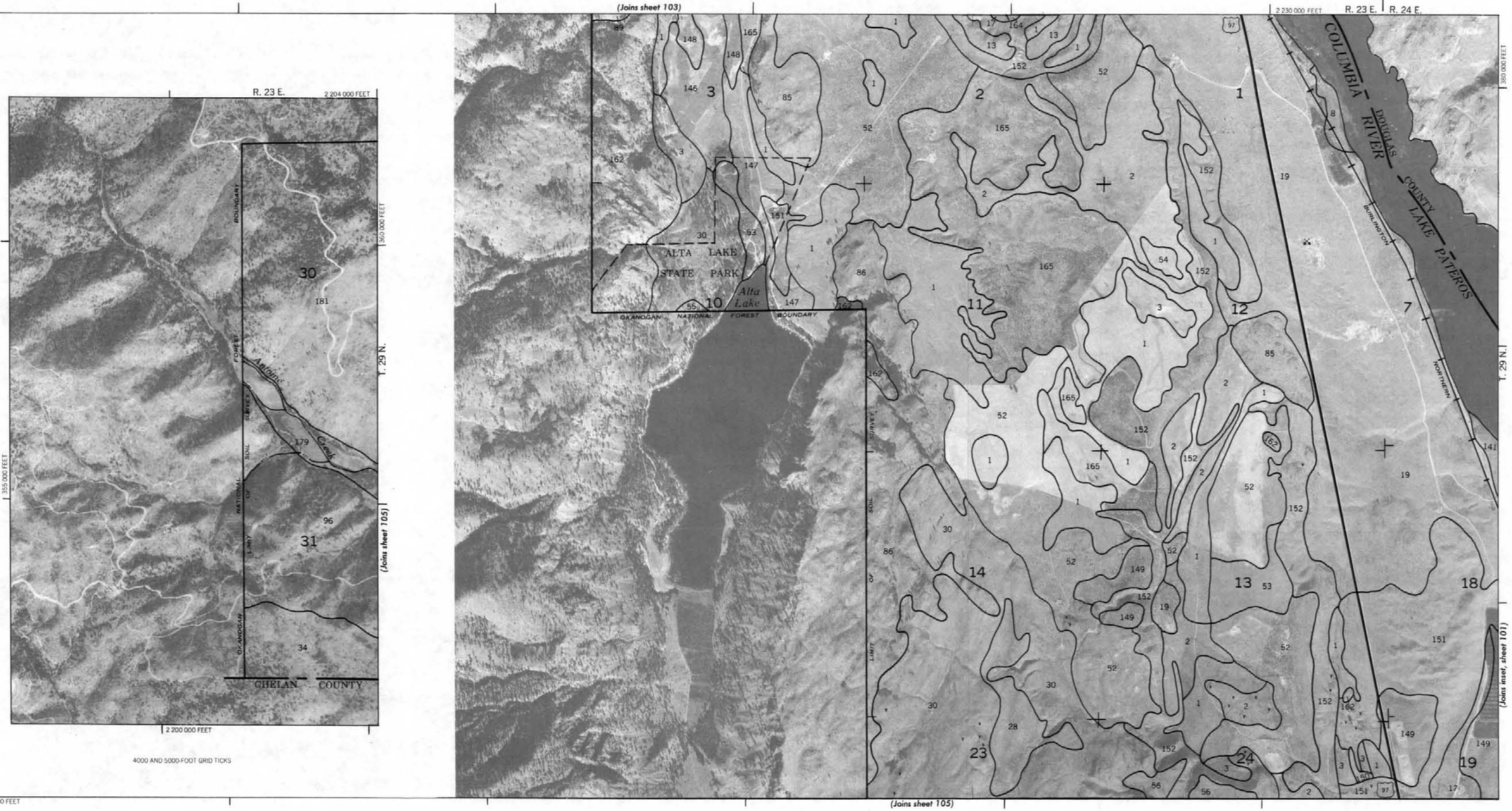
Scale 1:20000

5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior, Geological Survey photobase by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies



N



5,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map was compiled on 1975 U.S. Department of The Interior Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.